

Immunization in practice

Modules 1-11



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva*

for 415.116
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World Health Organization
Geneva
1998

*Given gratis by
Dr Sylvia Schwarzaj
To
12/3/04*

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The *Immunization in practice* training series comprises:

Modules 1-11 (grouped in a single document)	WHO/EPI/TRAM/98.01-11
Learning activities manual	WHO/EPI/TRAM/98.12
Trainers' guide	WHO/EPI/TRAM/98.13

This series, produced in 1998, revises and replaces the original 1984 version (and all intermediate revisions) of *Immunization in Practice*.

In addition to standard hard copies, each module is available on diskette in *Microsoft Word for Windows* (Word 97). This is to give users the opportunity to modify and reproduce the materials locally to suit specific training requirements.

The modules are also available on the Internet (in Word 97 and PDF format) at:
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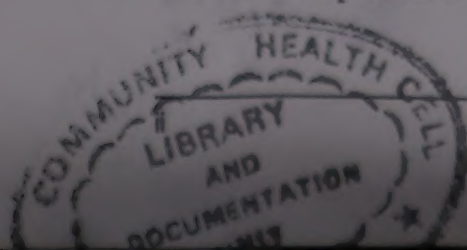
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Introduction to the course

Immunization in Practice is intended for the health workers who deliver immunization services to the children and women of the world. By observing the procedures described in this manual they will be directly involved in efforts aimed at:

- reducing measles cases by 90%, eliminating neonatal tetanus, and eradicating polio;
- achieving and maintaining 90% immunization coverage with all childhood vaccines;
- ensuring vaccine quality at the point of use;
- ensuring the safety of injections.

Immunization in Practice is both a training and reference manual. Covering the knowledge, skills and attitudes that health workers need in order to provide immunization services, it includes sections on:

- the target diseases;
- the vaccines that prevent the diseases;
- the cold chain - how vaccines are cared for;
- ensuring safe injections;
- organizing immunization sessions;
- registering and assessing immunization clients;
- preparing vaccines for use;
- giving immunizations;
- tasks following an immunization session;
- communicating with parents and involving communities;
- monitoring immunization coverage;
- monitoring cases - disease surveillance.

Many of the procedures described in this manual have always been important. Some, however, have been developed since the publication of its first edition in 1984, and improved equipment has been introduced. You will find this manual useful whether you are learning how to give immunizations or have been giving them for a long time.

Immunization in practice

Module 1:

EPI target diseases



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About this module

Six of the diseases that kill or disable children have been a part of the immunization programmes of most countries for many years. They are:

- tuberculosis;
- diphtheria;
- poliomyelitis;
- measles;
- pertussis;
- tetanus.

EPI has recently added hepatitis B and yellow fever to the list of target diseases. It is recommended that hepatitis B vaccine be integrated into national immunization programmes and that immunization against yellow fever should be performed in all countries where this disease is endemic.

Some countries include vaccines against other other diseases, for instance mumps, rubella and streptococcal pneumonia, in their immunization programmes, or may do so in the future. The decision to do so depends on the public health importance of the diseases, the availability of a safe, effective and affordable vaccine supply, and other factors. If your programme covers any additional diseases you should ask your supervisor for information.



1. Tuberculosis (TB)

1.1 What is tuberculosis?

Tuberculosis is caused by a bacterium (*Mycobacterium tuberculosis*) that is carried by almost 2 billion people. The disease killed more than 3 million people in 1995. It usually attacks the lungs, but other parts of the body, including the bones, joints and brain can also be affected.

There is a difference between tuberculosis infection and disease. People with the infection only do not feel ill and have no symptoms. The infection may last for a lifetime and the infected person may never develop the disease. Persons with the infection but not the disease cannot spread the infection to others.

People of all ages can contract tuberculosis. It spreads rapidly, particularly where people are living in crowded conditions, have poor access to care, and are malnourished.

1.2 How is tuberculosis spread?

Tuberculosis is spread through the air. When a person with the disease coughs or sneezes the germs enter the air. A person inhaling air that contains TB germs may become infected. TB can spread rapidly where people are living in crowded conditions, have difficulty in obtaining medical care, and are poorly nourished. In some areas it is possible to become infected from cattle with the disease, for instance by consuming unpasteurized milk.

The incubation period is 4-12 weeks but the infection may persist for months or years before the disease develops. A person with the disease can infect others for several weeks after he or she begins treatment. The risk of developing TB is highest in children aged under 3 years and in very old people, although anyone may be affected. Persons with TB infection who have weakened immune systems, for instance people with HIV/AIDS, are more likely to develop the disease than are those with normal immune systems.

Concern about TB has been heightened recently because some strains of the causative organism have developed resistance to drugs.

1.3 What are the signs and symptoms?

The symptoms of TB include general weakness, weight loss, fever and night sweats. In TB of the lungs (pulmonary TB) the symptoms include persistent cough, the coughing up of blood, and chest pain. However, in young children the only sign of pulmonary tuberculosis may be stunted growth or failure to

thrive. Other signs and symptoms depend on the part of the body that is affected. For instance, in TB of the bones and joints there may be swelling, pain and crippling effects in the hips, knees or spine.

1.4 What are the complications?

TB weakens the body generally, increasing the likelihood that the affected person will contract other diseases or that existing diseases will become more severe.

1.5 How is tuberculosis treated?

People with TB must complete a course of curative therapy, which usually includes taking two or more anti-tuberculosis drugs for at least six months. Unfortunately, some people fail to take the medications as prescribed or to complete their course of therapy, or they may be given ineffective treatments. This may lead to multi-drug-resistant TB, which can be spread to other people.

1.6 How is tuberculosis prevented?

The best protection available for children against tuberculosis infection is immunization with BCG vaccine. In persons who have been thus immunized it is impossible to determine whether a positive tuberculin skin test reaction is caused by the immunization or by infection with the TB bacterium. However, such individuals can be further examined to determine whether they are infected.

2. Diphtheria

2.1 What is diphtheria?

Diphtheria is caused by a germ called *Corynebacterium diphtheriae*. Major epidemics have occurred in Eastern Europe and Central Asia since the late 1980s. It tends to be a disease of the colder months and of temperate climatic zones.

The germ produces a toxin that can harm or destroy human body tissues and organs. One type of the disease affects the pharynx and other parts of the throat. Another type, commoner in the tropics, causes ulcers on the skin.

Diphtheria affects people of all ages, but mostly non-immunized children under 15 years of age.

2.2 How is diphtheria spread?

The type of diphtheria that affects the throat is spread in droplets and secretions from the nose, throat and eyes when there is close contact between infected and uninfected people. The other type is spread through contact with skin ulcers. This form of the disease is often disseminated on clothing and other articles that have been contaminated with fluid from skin ulcers.

People infected with diphtheria usually become ill within two to four days, although the symptoms may not appear until six days have elapsed. Infected individuals can usually spread the disease to others for up to four weeks, although rarely this can happen for up to six months. During outbreaks and epidemics some children may carry the germ without showing any signs or symptoms but can still spread the disease to other people.

The spread of the disease is favoured in overcrowded and poor living conditions.

2.3 What are the signs and symptoms?

When diphtheria affects the throat and tonsils, the early symptoms are sore throat, loss of appetite and slight fever. Within two to three days a bluish-white or grey membrane forms in the throat and tonsils. If there is bleeding the membrane may become greyish-green or black. It sticks to the soft palate of the throat, and bleeding may occur if attempts are made to remove it. The patient may recover at this point or may develop severe weakness and die within six to ten days. Patients with severe disease do not show high fever but may develop swelling of the neck and obstruction of the airway.

In the type of diphtheria affecting the skin, the lesions may be painful, reddened and swollen. Any chronic skin lesions may become infected with diphtheria.

2.4 What are the complications?

Abnormal heart beats may occur during the early phase of the illness or weeks later, and heart failure may result. There may be inflammation of the heart muscle and valves, leading after many years to chronic heart disease and heart failure. Death occurs in 5-10% of cases.

2.5 How is diphtheria treated?

Persons in whom diphtheria is suspected should be given diphtheria antitoxin and antibiotics such as erythromycin or penicillin, and should be isolated to avoid exposing others to the germs. Throat cultures should be obtained in order to secure correct diagnosis. Patients become non-infectious about two days after the commencement of antibiotic treatment.

2.6 How is diphtheria prevented?

The most effective way of preventing diphtheria is to maintain a high level of immunization in the community. A mother can pass protective antibodies to her baby but this protection lasts only about six months.

In most countries, diphtheria toxoid vaccine is given together with pertussis vaccine and tetanus toxoid. A combination of tetanus and diphtheria vaccine may be recommended as a booster to maintain protection every ten years.

Diphtheria is spread from person to person in airborne droplets and through close contact.

The disease can spread rapidly and result in large epidemics where immunization coverage is low.

It most often affects children under 15 years of age.

The most effective way to prevent diphtheria is to maintain a high level of immunization coverage in the community.

3. Poliomyelitis (polio)

3.1 What is polio?

Polio is caused by a virus. It is a crippling disease that can occur in adults but it is much commoner in children. WHO aims to eradicate polio by the year 2000.

3.2 How is polio spread?

The virus enters the body through the mouth when people eat food or drink water contaminated by faeces carrying it. Consequently, the disease is most likely to spread in areas of poor sanitation. The virus enters the bloodstream and may invade certain types of nerve cell, which it can damage or destroy.

It also occurs in throat secretions, and is sometimes spread in airborne droplets through close contact with persons carrying the infection who are sneezing or coughing, or through exposure to throat and nose secretions in other ways.

The disease is very easily spread. Nearly all children living in households where someone is infected themselves become infected. Persons are most likely to spread the virus seven to ten days before and seven to ten days after they first experience symptoms of the disease. Infected persons who do not have symptoms can also spread the disease.

Many people who contract polio do not become seriously ill but may spread the disease to others who may become ill.

About 1 child in every 100 infected by the polio virus develops paralysis.

3.3 What are the signs and symptoms?

People infected with the virus may not feel ill. Some may have influenza-like symptoms such as fever, loose stools, sore throat, stomach upset, headache or stomachache. Sometimes there may be pain or stiffness in the neck, back and legs.

The most serious form of the disease is paralytic polio. It begins with the milder forms but usually causes severe muscle pain as well as the other symptoms. Paralysis usually develops during the first week of illness. The use of one or both legs or arms may be lost, and breathing may be impossible without the help of a respirator. The degree of recovery varies from person to person.

In childhood polio there is initially a slight fever. Within three to five days the child develops a headache, stiff neck, and muscle pain, and the fever then increases. After a further period of one to three days the child becomes paralysed in the legs, arms, face or chest.

The incubation period ranges from 3 to 35 days. Laboratory testing of the stools or throat secretions is used to confirm cases of polio.

3.4 What are the complications?

About 1% of infected children become paralysed, and a larger percentage of these children have some permanent paralysis. Death may occur if the muscles used for breathing are paralysed and no respirator is available.

3.5 How is polio treated?

There is no treatment but the symptoms can be relieved somewhat. Sometimes the patient has to use a respirator in order for breathing to continue.

3.6 How is polio prevented?

Polio prevention involves immunization with oral polio vaccine (OPV). Antibodies from the mother provide protection to the infant for two to three months after birth. Infected people who recover can develop natural immunity that protects them against future infection.

OPV is recommended by EPI for the eradication of polio. It is cheap, easy to give, highly effective and safe. The EPI schedule comprises four doses, starting at birth and ending at 14 weeks of age.

Polio is caused by a virus and can lead to severe, possibly lifelong, paralysis.

The disease is easily spread from person to person and from hand to mouth, through eating food or drinking water that has been contaminated with faeces from an infected individual.

The recommended method of prevention in children is to immunize with oral polio vaccine (OPV).

WHO aims to eradicate polio by the year 2000.

4. Measles

4.1 What is measles?

Measles kills more children than any other of the EPI target diseases. It is caused by a virus and is highly infectious, i.e., very easily spread. It is constantly present in some populations and often occurs in epidemic proportions. In conditions of crowding and poverty where large numbers of non-immunized people are in close contact the stage is set for measles epidemics. The disease is more severe in infants and adults than in children.

Measles is one of the main causes of death among young children. Over 1 million were killed by the disease in 1995.

Infants and adults are especially likely to have severe complications resulting from measles.

4.2 How is measles spread?

Measles is spread by contact with nose and throat secretions of infected people and in airborne droplets released when an infected person sneezes or coughs. Transmission by airborne droplets can occur even two hours after an infected person has left a room or other closed area.

An infected person can infect others a few days before and for several days after he or she develops symptoms. The disease spreads easily wherever infants and children gather together.

4.3 What are the signs and symptoms?

The incubation period ranges from 7 to 18 days. The first sign of infection is a high fever lasting one to seven days. During this period there may be a runny nose, cough, red and watery eyes, and small white spots inside the cheeks. After several days a slightly raised rash develops, spreading from the face and upper neck to the body and then to the hands and feet over a period of about three days. It lasts for five to six days and fades successively from the same areas. There may also be loss of appetite and loose stools, especially in infants.

4.4 What are the complications?

Complications occur particularly in children aged under 5 years and in adults aged over 20 years. Severe diarrhoea may be a problem, especially in infants,

possibly causing dehydration. In children there may be inflammation of the middle ear, respiratory tract infections and croup.

Pneumonia is the commonest cause of death associated with measles. This is usually because the measles virus weakens the immune system. The pneumonia may be caused by the measles virus itself or by other germs. Encephalitis, a dangerous swelling of the brain, may also develop.

Children aged under 12 months, if not immunized, are the most likely to acquire measles infection. Severe measles is particularly likely in poorly nourished children, especially those not receiving sufficient vitamin A, in children living in crowded conditions, and in those with immune systems that have been weakened by AIDS or other diseases. Measles is a major cause of blindness among children in Africa.

People who recover from measles are immune for the rest of their lives, and infants born to mothers who have had measles are usually immune for six to eight months.

4.5 What is the treatment for measles?

The treatment of children suffering complications of measles can save their lives. Vitamin A administration can help to avoid the complications of eye damage and blindness. All children with severe measles, and all children in developing countries with measles, should receive vitamin A supplementation as soon as they are seen at a health facility, and a second dose should be given the next day. General nutritional support and the treatment of dehydration with oral rehydration solution may be necessary. It is very important to encourage children with measles to eat and drink.

4.6 How is measles prevented?

The prevention of measles involves immunization with measles vaccine. Children should receive one dose before the age of 1 year. In some countries, measles vaccine is combined with vaccines against the mumps and rubella viruses. Two doses of measles vaccine are recommended in some instances, as in refugee camps where there is a high probability of exposure to the disease.

Children should be immunized against measles on admission to hospital because of the danger of infection. If they are aged 6-9 months the initial dose should be followed by a second as soon as possible after the age of 9 months. Children admitted to hospital with measles should be isolated for at least four days after the skin rash appears. Malnourished children with measles should be isolated for the duration of the illness.

Some 124 million children under 5 years of age suffer vitamin A deficiency. In areas known to be deficient in vitamin A it can be given at the same time as measles vaccine or any other recommended EPI vaccine.

Measles is a highly infectious viral disease that is spread from person to person through sneezing, coughing and close personal contact.

It is the main killer of children among the EPI target diseases.

All children should receive measles vaccine before the age of 1 year.

Severe complications of measles can be avoided if proper treatment is given.

5. Pertussis

5.1 What is pertussis?

Pertussis, or whooping cough, is a disease of the respiratory tract caused by a germ called *Bordetella pertussis* which lives in the mouth, nose and throat. Many children with pertussis have coughing spells lasting four to eight weeks. The disease is common in non-immunized children everywhere. It has become increasingly so in recent years and severe epidemics have occurred in countries where immunization coverage has declined. The disease is most dangerous in children aged under 1 year.

5.2 How is pertussis spread?

Pertussis spreads very easily from person to person in droplets produced by coughing or sneezing. Most persons exposed to the germs become infected. In many countries the disease occurs in regular epidemic cycles of three to five years. The most susceptible people are the youngest non-immunized children.

The disease is most readily transmitted as from seven days after a person has been exposed to the germs until three weeks after the start of coughing. The incubation period can be up to 21 days.

Young infants are the most likely to contract pertussis and the most likely to develop bacterial pneumonia, a life-threatening complication.

There were some 40 million whooping cough infections in 1955.

5.3 What are the signs and symptoms?

There are usually three stages in the illness. Initially a child appears to have a common cold, with runny nose, watery eyes, sneezing, fever and a mild cough. The cough gradually worsens and the second stage involves numerous bursts of rapid coughing. At the end of these bursts the child takes in air with a high-pitched whoop. The child may turn blue because of a lack of oxygen during a long burst of coughing. Vomiting and exhaustion often follow the coughing attacks, which are particularly frequent at night. This stage usually lasts one to six weeks but may go on for up to ten weeks. The attacks become milder with the passage of time.

In the third stage, when recovery takes place, the coughing gradually becomes less intense and stops in two to three weeks. There is not usually a high fever during the illness.

5.4 What are the complications?

Complications are most probable in young infants. The commonest and the cause of most deaths is bacterial pneumonia. Convulsions and seizures may occur, these complications arising because of the reduced oxygen supply to the brain during coughing attacks or because of the toxins released by the pertussis germs. Less serious complications include loss of appetite, inflammation of the middle ear, and dehydration.

5.5 What is the treatment for pertussis?

Treatment with an antibiotic, usually erythromycin, may make the illness less severe. The use of antibiotics also reduces the ability of the patient to infect others because the medicaments kill germs in the nose and throat. Plenty of fluids should be given to prevent dehydration. Sometimes people in the same household as a patient are given antibiotics to reduce the probability of infection.

5.6 How is pertussis prevented?

Prevention involves immunization with pertussis vaccine, which is usually given in combination with diphtheria and tetanus vaccines. Newborns and infants are not protected against pertussis by maternal antibodies. A person infected with pertussis usually acquires lifelong immunity.

Pertussis is a bacterial infection spread from person to person by sneezing and coughing.

The disease is extremely contagious, especially where people live in crowded conditions and nutrition is poor.

Infants and very young children are the people most likely to be infected, to have serious complications, and to die from the disease.

The most effective way to prevent pertussis is to immunize all children aged under 1 year.

6. Tetanus

6.1 What is tetanus?

In tetanus or lockjaw the affected person's muscles all contract, making the body stiff. The disease is particularly common and serious in newborn babies, when it is called neonatal tetanus.

Tetanus is caused by the germ *Clostridium tetani*, which grows in dead tissue, for instance in a wound or in a baby's umbilical cord. The germ is common in the environment, often occurring in soil containing manure. The bacteria form spores that can survive in the environment for years. The toxin they produce poisons the nerves that control the muscles, and this causes stiffness.

People of all ages can catch tetanus. Neonatal tetanus kills between 500 000 and 1 million babies every year. Almost all babies who catch the disease die. It is particularly common in rural areas and tropical lowlands.

6.2 How is tetanus spread?

Tetanus is not transmitted from person to person. A person may become infected if soil or dung enters a wound or cut. This may happen, for example, if a wound is made with a dirty tool. Tetanus germs are likely to grow in deep puncture wounds caused by dirty nails, needles, barbed wire, thorns, wood splinters and animal bites.

A newborn baby may become infected if the knife, razor or other instrument used to cut the umbilical cord is dirty. Infection may also occur if cow dung or ash is used to dress the cord, or if soil enters the baby's navel. If the hands of the person delivering are not clean the baby may become infected. Infants and children may also contract tetanus when dirty instruments are used for circumcision, scarification and skin-piercing, and when dirt, charcoal or other unclean substances are rubbed into a wound.

Neonatal tetanus remains a serious problem in countries with poor immunization coverage and unclean practices associated with childbirth.

If untreated, tetanus is a very serious disease at any age. Almost every person contracting tetanus dies.

6.3 What are the signs and symptoms?

In newborn babies the symptoms usually appear 4-14 days after birth. The incubation period is usually between three and ten days but may be as long as three weeks. The shorter the incubation period, the higher is the risk of death.

Muscular stiffness in the jaw is a common first sign. This is followed by stiffness of the neck, difficulty in swallowing, stiffness of the stomach muscles, muscle spasms, sweating and fever.

Newborn babies with tetanus appear normal at birth but stop sucking three to ten days later. At 5-13 days they are still not breast-feeding, the whole body becomes stiff, severe muscle contractions and convulsions occur, and death follows in most cases.

6.4 What are the complications?

Fractures of the spine or other bones may occur as a result of muscle spasms and convulsions. Abnormal heartbeat, coma, pneumonia and other infections may also occur. Death is particularly likely in very young and old age groups.

6.5 What is the treatment for tetanus?

Wounds should be thoroughly cleaned and dead tissue should be removed. For persons with wounds that are neither clean nor minor and who are not fully protected against tetanus, tetanus immune globulin should be given.

Antibiotics may also be used.

Persons who recover from tetanus do not have natural immunity.

6.6 How is tetanus prevented?

The prevention of neonatal tetanus requires women of childbearing age to receive tetanus toxoid. This results in the protection of mothers and in tetanus antibodies being transferred from them to their fetuses. Infants are thus protected against the disease at birth. Clean practices during delivery and clean wound care are also very important in preventing tetanus.

All children should be immunized against tetanus because antibodies transferred from the mother before birth last for only a few months. Tetanus is caused by a germ found in the natural environment.

Infection occurs when unclean objects puncture or cut the skin and umbilical cord and during unclean delivery practices.

Nearly all newborns with tetanus die.

The most important way to achieve prevention is to immunize women of childbearing age and to ensure clean delivery practices.

7. Hepatitis B

7.1 What is hepatitis B?

This disease, caused by the hepatitis B virus, affects the liver. People usually recover, but some continue to carry the virus for many years and can spread the infection to others throughout the time that they are chronic carriers. It is estimated that there are about 350 million carriers of hepatitis B virus.

7.2 How is hepatitis B spread?

The hepatitis B virus is carried in the blood, saliva, semen, vaginal fluids and most other body fluids. However, it is usually spread by contact with blood in the following ways:

- Injection with unsterilized needles or syringes containing hepatitis B virus from an infected person, for instance another patient or a needle-user.
- Transmission of hepatitis B virus by mothers to their babies during the birth process, when contact with blood always occurs.
- Transmission between children during social contact through cuts, scrapes and scratches.
- Transmission during sexual intercourse through contact with blood or other body fluids.

The virus does not occur in an infected person's stools unless they contain blood. It does occur in the milk of infected mothers but in such small amounts that nursing can proceed.

The disease occurs all over the world and can affect all age groups. Most chronic carriers are in China, South-East Asia, and Africa.

The incubation period averages six weeks but may be as long as six months.

7.3 What are the signs and symptoms?

The younger a person is when infected the more likely it is that he or she will show no signs or symptoms. A person with no symptoms may remain infected for many years and can spread the infection to others. Such a person is more likely than one showing symptoms to suffer complications caused by liver damage in the long term.

Infected people may feel weak and may experience stomach upsets and other influenza-like symptoms. They may also have very dark urine or very pale stools. Jaundice may appear as yellow skin or a yellow colour in the whites of

the eyes. The symptoms may last several weeks. General weakness and fatigue may continue for months. A laboratory blood test is required to determine with certainty whether a person has hepatitis B virus or disease.

Most acute infections in adults are followed by complete recovery, and the affected people rarely become chronic carriers. However, many children, even though they are not acutely ill as a rule, do become chronic carriers, and many develop severe complications.

7.4 What are the complications?

Infected persons who recover and do not become carriers possess antibodies and are protected throughout their lives.

The consequences of acute infection can be severe. Death occurs in a small percentage of adults. Most serious complications, including chronic hepatitis, cirrhosis, liver failure and liver cancer, occur in persons with chronic infection.

There are about 150 million carriers of hepatitis B virus, most of whom are unaware that they are carriers.

Most babies born to mothers who are carriers also become carriers.

About 25% of untreated babies who are infected with hepatitis B virus subsequently develop severe chronic liver disease or even liver cancer.

Hepatitis B kills some 1.1 million people annually.

7.5 What is the treatment for hepatitis B?

There is no treatment for the acute condition. In chronic infection the disease can sometimes be stopped by certain medications.

7.6 How is hepatitis B prevented?

Safe and effective hepatitis B vaccine is available. EPI recommends that children receive three doses during the first year of life, the first dose being administered either at birth or at about six weeks of age on the occasion of the first clinic visit, and the third at 14 weeks. If possible all pregnant women should be tested to determine whether they carry the virus in their blood. Babies of mothers who are carriers should then receive an injection of hepatitis B antibodies (hepatitis B immune globulin) together with the first dose of vaccine at birth.

In some countries the hepatitis B vaccine is offered to or recommended for adolescents and young adults, since the virus is sexually transmitted and is also easily spread through needle-sharing.

Persons with hepatitis B virus should not donate blood and should not allow other persons to come into contact with their blood or other body fluids. They

should use barrier methods when having sex and should not share eating utensils, toothbrushes, needles or razors with other people.

Health care workers should use all necessary precautions with all patients because patients who are carriers of the virus can spread the infection to them quite easily through blood contact.

The hepatitis B virus is spread through contact between people's blood and other body fluids.

The disease occurs in both acute and chronic forms.

The younger a person is on becoming infected, the less probable it is that symptoms will occur but the more probable it is that he or she will become a carrier of the disease and develop a severe liver condition later.

Most people are infected by non-symptomatic carriers of the disease, and many children are infected by mothers who are carriers.

All children should receive hepatitis B vaccine, starting at birth or at the age of 4-6 weeks, when the first visit to a clinic takes place.

8. Yellow fever

8.1 What is yellow fever?

Yellow fever, an acute disease of short duration, is caused by a virus. It occurs in tropical and subtropical areas, mainly in sub-Saharan Africa and Central and South America, and affects people of all ages.

8.2 How is yellow fever spread?

The yellow fever virus is spread by mosquitos when they bite humans. It is not spread directly from person to person. The mosquitos act as hosts for the infection and deliver it to people, and are said to be vectors of the disease. They breed in small accumulations of stagnant water. Once infected, mosquitos carry the virus for life.

Mosquitos may acquire the virus by biting either infected monkeys or infected humans, and they can subsequently spread it to humans.

8.3 What are the signs and symptoms?

The illness may be so mild that it is not noticed or diagnosed. It can be confused with malaria, hepatitis and other diseases. Three to six days after a person has been infected by a mosquito he or she suddenly develops fever, chills, headache, backache, general muscle pain, upset stomach and vomiting. When the disease progresses the person becomes slow and weak and there is bleeding of the gums and blood in the urine. There may be jaundice and black vomiting.

8.4 What are the complications?

The disease usually lasts two weeks, after which the patient either recovers or dies. Death may follow convulsions and coma. In areas where the disease is endemic about 5% of infected persons die from the disease. In epidemics, when large numbers of people are infected during a short period, up to 50% of infected people may die.

Yellow fever is diagnosed by performing a laboratory blood test. Persons recovering from yellow fever have lifelong immunity.

Yellow fever causes about 30 000 deaths annually.

Children in 33 African countries are at highest risk for the disease.

The disease is of short duration and can be fatal.

8.5 What is the treatment for yellow fever?

There is no specific treatment. Patients may require fluids to compensate for dehydration.

8.6 How is yellow fever prevented?

The disease is prevented by immunization with yellow fever vaccine, which is given to children in a single dose, usually when they are aged 9 months and at the same time as measles vaccine. The vaccine is very safe and effective, producing antibodies against yellow fever which can last for 30 years or longer.

Prevention should also involve the elimination of the accumulations of stagnant water in which the vector mosquitos breed.

Yellow fever is caused by a virus that is transmitted by mosquitos.

It is an acute disease from which patients either recover completely or die.

There is a safe and effective vaccine against the disease for children.

EPI recommends that children in 33 African countries should be given the vaccine.

Glossary

Acute	Of short duration (not chronic).
Antibodies	Proteins in the blood which give a person immunity to an infection; they may be produced as a result of vaccination or natural infection.
Carrier	A person or animal that has germs of a certain infection but does not show symptoms of disease. A carrier can transmit the infection to other people.
Chronic	Of long duration (not acute).
Croup	Any affliction in children which involves the throat, with difficult noisy breathing and a hoarse cough.
Disease	Illness.
Immunity	Resistance and protection against an infection or disease, resulting from previous exposure to the infection or from vaccination.
Incubation period	The time interval between first contact with a germ and the appearance of the first sign or symptom of disease.
Infection	Entry and multiplication of an infectious agent into the body.
Signs	Abnormal conditions indicating disease, discovered by examination of a patient.
Symptoms	Abnormal function, appearance or sensation indicating a disease, as experienced by a patient.
Toxin	Poisonous substance formed during growth of germs.
Toxoid	A toxin, treated to destroy any poisonous properties, which is capable of stimulating the body to produce antibodies and thereby create immunity to an infection or disease.

Immunization in practice

Module 2:

EPI vaccines



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



World Health Organization
Geneva
1998

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The *Immunization in practice* training series comprises:

Modules 1-11 (grouped in a single document)	WHO/EPI/TRAM/98.01-11 Rev.1
Learning activities manual	WHO/EPI/TRAM/98.12
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About this module

This module describes seven EPI disease-preventing vaccines:

- **bacillus Calmette-Guérin (BCG) vaccine (tuberculosis vaccine);**
- **oral polio vaccine (OPV);**
- **diphtheria-pertussis-tetanus (DPT) vaccine;**
- **hepatitis B (HB) vaccine;**
- **measles vaccine;**
- **yellow fever vaccine;**
- **tetanus toxoid (TT).**

For each vaccine the description explains:

- **what it is;**
- **how it is stored;**
- **when it is given;**
- **the number and size of doses;**
- **where and how it is given;**
- **any side-effects that may occur.**

Side-effects of EPI vaccines are uncommon and the benefits of their use far outweigh any discomfort that might occur.

A section on contraindications follows the descriptions of the vaccines.

1. BCG vaccine

1.1 What it is

BCG vaccine protects against tuberculosis in infants.

The letters, B, C and G stand for bacillus of Calmette and Guérin. “Bacillus” describes the shape of a bacterium; Calmette and Guérin are the names of the people who developed the vaccine.

BCG vaccine comes in powder form and before use must be reconstituted with the accompanying diluent. The reconstituted vaccine is even more sensitive to heat than the powder and must therefore be used within six hours or disposed of.

Before the reconstitution of BCG, measles and yellow fever vaccines they are more heat stable than OPV and certain other vaccines but after reconstitution they are less stable.

1.2 How it is stored

BCG vaccine and diluent should be stored at a temperature between 0 C and +8° C.

BCG vaccine is not damaged by freezing.

Store BCG vaccine and its diluent side-by-side in a refrigerator or vaccine carrier.

1.3 When it is given

BCG vaccine is given at birth or as soon as possible thereafter.

It should not be given to children who have signs and symptoms of AIDS.

1.4 The number and size of doses

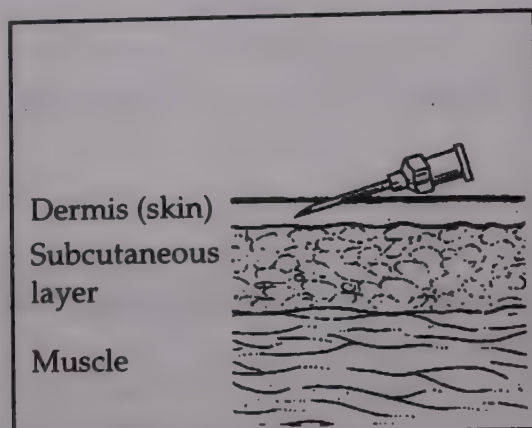
One dose of 0.05 ml.

If a child has diarrhoea when you give BCG vaccine, administer another dose at least four weeks later. If there is no scar at the injection site six weeks after a BCG immunization, the injection must be repeated. If there is still no scar six weeks after the second injection the child should be referred to a physician.

1.5 Where and how it is given

BCG vaccine is usually injected in the top layer of the skin of the upper left arm. Health workers use the same place on every child for BCG injections so that everyone knows where to look for the scar.

Figure 2-A: Needle position for injection of BCG vaccine (intradermal)



1.6 Side-effects

Normal reaction

When BCG vaccine is injected a small raised lump appears at the injection site. This usually disappears within 30 minutes.

After approximately two weeks a red sore develops which is 10 mm in diameter (the size of the end of an unsharpened pencil).

The sore remains for another two weeks and then heals. A small scar, about 5 mm across, remains. This is a sign that the child has been effectively immunized.

Swelling of glands or formation of abscess

Sometimes the glands in a child's armpit or near the elbow swell up after injection with BCG vaccine, or he or she may develop an abscess. Swollen glands or abscesses occur because:

- an unsterile needle or syringe was used;
- too much vaccine was injected;
- the vaccine was injected under the skin instead of in its top layer.

BCG: Administration guidelines

	Recommendation	Comment
Age	<u>Birth</u>	If not given at birth, <u>any time thereafter.</u>
Dose size	Usually <u>0.05 ml</u>	See the manufacturer's instructions. If child is <u>over 1 year old</u> , give 0.1 ml.
Number of doses	One	
Injection site	Upper left arm in top layer of skin.	

2. Oral polio vaccine

2.1 What it is

Oral polio vaccine (OPV) gives protection against the three types of virus that cause polio.

It is a liquid that comes in two types of containers: small plastic bottles that work like droppers, and glass vials with droppers in a separate plastic bag. As from January 1996 all OPV vials supplied by WHO/UNICEF have had a vaccine vial monitor (VVM) attached. The VVM shows health workers whether the OPV in the vial to which the monitor is attached is safe to use.

2.2 How it is stored

OPV should be stored at a temperature between 0° C and +8° C.

It is easily damaged by heat but is not harmed by freezing.

2.3 When it is given

OPV should be given at:

- birth;
- 6 weeks of age;
- 10 weeks of age;
- 14 weeks of age.

The interval after the second and third doses must be at least four weeks.

2.4 The number and size of doses

Four doses are given, each of two drops.

If a child has diarrhoea, give OPV as usual but administer an extra dose, i.e., a fifth dose, at least four weeks after he or she has received the last dose in the schedule.

2.5 Where and how it is given

OPV is dropped in the mouth with the dropper that comes with the vaccine.

2.6 Side-effects

OPV has no side-effects.

Oral polio vaccine: Administration guidelines

	Recommendation	Comment
Age	Dose 0 – birth Dose 1 - 6 weeks Dose 2 - 10 weeks Dose 3 - 14 weeks	There must be at least 4 weeks between doses 1 and 2 and between doses 2 and 3.
Dose size	Usually two drops.	See the manufacturer's instructions.
Number of doses	Four	
Immunization site	Mouth	

3. Diphtheria-pertussis-tetanus vaccine

3.1 What it is

Diphtheria-pertussis-tetanus (DPT) vaccine is made from:

- diphtheria toxoid;
- pertussis vaccine;
- tetanus toxoid.

If DPT vaccine stands for a long time it separates from the liquid and looks like fine sand at the bottom of the vial. Shaking the vial mixes the vaccine and liquid again.

3.2 How it is stored

DPT vaccine should be stored at a temperature between 0° C and +8° C.

The diphtheria and tetanus toxoid parts of DPT vaccine are damaged by freezing. Pertussis vaccine is damaged by heat.

To check if DPT vaccine has been frozen, shake the vial. If granules appear a short time afterwards the vaccine has been spoiled and you must dispose of it. This is called the shake test (see Module 3).

3.3 When it is given

DPT vaccine should be given at the ages of:

- 6 weeks;
- 10 weeks;
- 14 weeks.

The interval after the first and second doses must be at least four weeks.

DPT vaccine should NOT be given to children over 5 years of age or to children who have suffered a severe reaction to a previous dose of this vaccine. Instead, a combination of diphtheria and tetanus toxoids (DT) should be given.

3.4 The number and size of doses

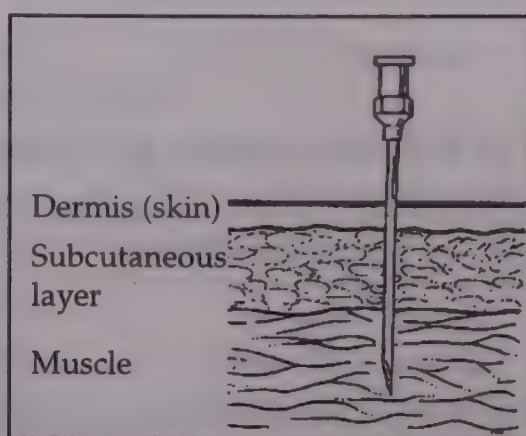
Three doses are given, each of 0.5 ml.

DPT boosters: Many countries recommend a booster dose of DPT vaccine at the age of 12 to 24 months. Ask your supervisor about the policy in your country.

3.5 Where and how it is given

DPT is injected into the muscle in the outer part of the thigh.

Figure 2-B: Needle position for injection of DPT vaccine (intramuscular)



3.6 Side-effects

Reactions to DPT vaccine are usually mild. They include:

Fever: A child may have fever the evening after receiving DPT vaccine. The fever should disappear within a day.

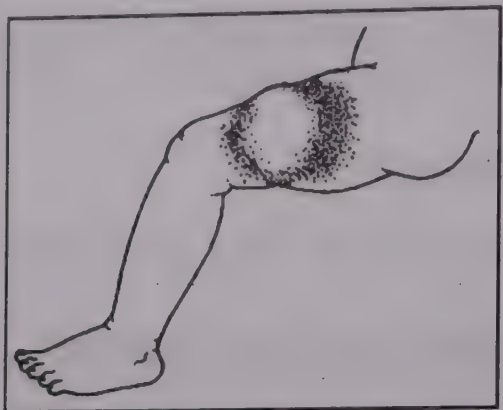
Note. Fever that begins more than 24 hours after a DPT injection is unlikely to be a reaction to the vaccine.

Soreness: Some children have pain, redness or swelling at the injection site.

Abscess: An abscess may develop a week or more after a DPT injection. This can happen because:

- an unsterile needle or syringe was used;
- the vaccine was not injected into the muscle.

Figure 2-C: Abscess caused by unsterile syringe or incorrectly administered injection



DPT: Administration guidelines

	Recommendation	Comment
Age	Dose 1 - 6 weeks Dose 2 - 10 week Dose 3 - 14 weeks.	If a child is not given DPT vaccine at 6 weeks, give it as soon as possible thereafter. Wait 4 weeks between doses. Complete all 3 doses before 6 months of age to avoid side-effects, which are commoner after that age.
Dose size	Usually 0.5 ml for each dose	See the manufacturer's instructions.
Number of doses	Three	
Injection site	Muscle of upper thigh.	Never immunize in the buttock.

4. Hepatitis B vaccine

Many countries include hepatitis B vaccine in their national immunization programmes or plan to do so in 1997.

4.1 What it is

Hepatitis B vaccine is a cloudy liquid that comes in a vial or a prefilled syringe. It does not have to be reconstituted.

If hepatitis B vaccine stands for a long time it separates from the liquid and looks like fine sand at the bottom of the vial. It must be mixed by shaking.

4.2 How it is stored

Hepatitis B vaccine should be stored at a temperature between 0° C and +8° C.

Both heat and freezing damage hepatitis B vaccine.

Use the shake test to find out if it has been frozen (see Module 3).

4.3 When it is given

Two different schedules are used, depending on when the disease is likely to be transmitted.

In places where transmission at birth is likely, the recommended schedule is:

- at birth, the same time as BCG vaccine and OPV0;
- at 6 weeks, the same time as DPT1 and OPV1;
- at 14 weeks, the same time as DPT3 and OPV3.

Where transmission at birth is less likely, the recommended schedule is:

- at 6 weeks, the same time as DPT1 and OPV1;
- at 10 weeks, the same time as DPT2 and OPV2;
- at 14 weeks, the same time as DPT3 and OPV3.

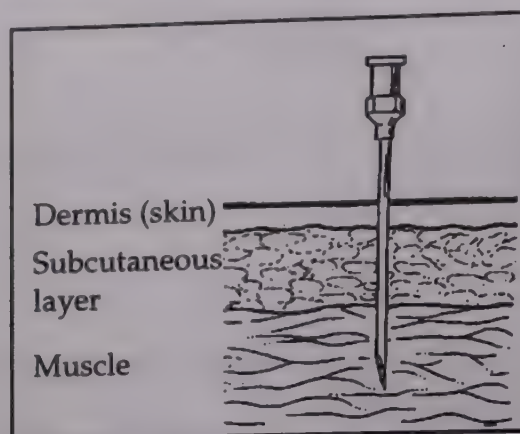
4.4 The number and size of doses

Three doses are given, each of 0.5 ml.

4.5 Where and how it is given

Hepatitis B vaccine is injected in the muscle of the upper thigh.

Figure 2-D: Needle position for hepatitis B injection (intramuscular)



Note. When DPT vaccine is given at the same time as hepatitis B vaccine, do not inject both in the same thigh.

4.6 Side-effects

A child may develop a mild fever for one or two days after an injection of hepatitis B vaccine.

Hepatitis B vaccine: Administration guidelines

	Recommendation	Comment
Age	Dose 1 - birth or 6 weeks Dose 2 - 6 or 10 weeks Dose 3 - 14 weeks	Ask your supervisor about the schedule in your country. Wait at least 4 weeks between each dose.
Dose size	Usually 0.5 ml for each dose	See the manufacturer's instructions.
Number of doses	Three	
Injection site	Muscle of the upper thigh	Never immunize in the buttock.

5. Measles vaccine

5.1 What it is

Measles vaccine comes in powder form together with a diluent. Before it can be used it must be reconstituted.

Reconstituted measles vaccine must be used within six hours or disposed of.

Note In countries where vitamin A deficiency occurs, vitamin A is often given at the same time as measles vaccine.

5.2 How it is stored

Measles vaccine and diluent should be stored at a temperature between 0° C and +8° C.

Dry measles vaccine is not damaged by freezing.

5.3 When it is given

Measles vaccine is usually given as soon as possible after 9 months of age.

Maternal antibodies against measles last longer than other antibodies, so immunization with measles vaccine is often not effective before 9 months of age. However, in special situations, for instance in urban areas with high measles transmission or where children below 9 months of age are getting measles, two doses may be given – at 6 months and 9 months of age.

Note: All children between 6 and 9 months of age who are admitted to hospital should be given a dose of measles vaccine. This should NOT be marked on their immunization cards. Another dose should be given at 9 months of age.

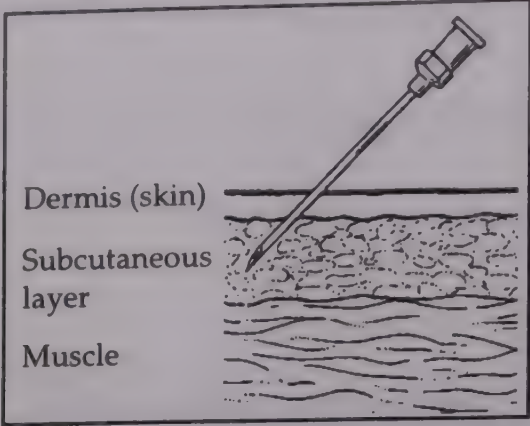
5.4 The number and size of doses

One dose of 0.5 ml is given.

5.5 Where and how it is given

Measles vaccine is injected into the subcutaneous layer of the upper left arm.

Figure 2-E: Needle position for measles injection (subcutaneous)



5.6 Side-effects

A mild fever and rash lasting one to three days may occur approximately a week after immunization.

Measles vaccine: Administration guidelines

	Recommendation	Comment
Age	9 months	If a child is not immunized at 9 months, immunize as soon as possible thereafter. A child aged 6 to 9 months who is immunized with measles vaccine when hospitalized should receive a second dose at 9 months of age.
Dose size	Usually 0.5 ml	See the manufacturer's instructions.
Number of doses	One	
Injection site	Subcutaneous injection in the upper right arm	

6. Yellow fever vaccine

Yellow fever vaccine is recommended as part of the national immunization programme in countries where the disease is endemic.

6.1 What it is

Yellow fever vaccine comes in powder form and must be reconstituted with its diluent before use.

Reconstituted vaccine must be used within six hours or disposed of.

6.2 How it is stored

Yellow fever vaccine and diluent must be stored at a temperature between 0°C and +8°C.

Reconstituted yellow fever vaccine is easily damaged by heat but not by freezing.

6.3 When it is given

Yellow fever vaccine is usually given at 9 months of age, at the same time as measles vaccine. It should NOT be given to children aged under 6 months.

Children who have signs and symptoms of AIDS vaccine should not be given the yellow fever vaccine.

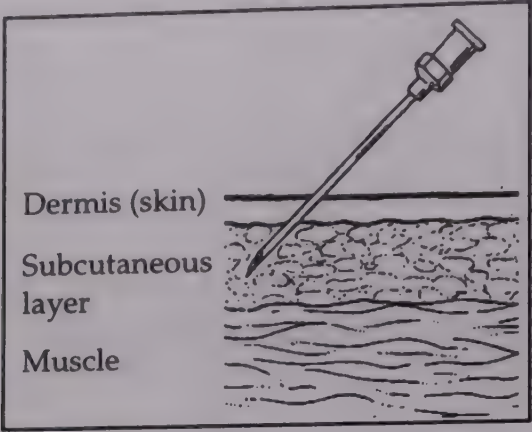
6.4 The number and size of doses

One dose of 0.5 ml is given.

6.5 Where and how it is given

The vaccine is given subcutaneously in the upper arm.

Figure 2-F: Needle position for injection yellow fever vaccine (subcutaneous)



When administered at the same time as measles vaccine it should be injected in the other arm.

6.6 Side-effects

Children may get fever, headache or mild muscle or joint pain after an injection of yellow fever vaccine.

Yellow fever vaccine: Administration guidelines

	Recommendation	Comment
Age	9 months	Not younger than 6 months.
Dose size	Usually 0.5 ml	See the manufacturer's instructions.
Number of doses	One dose	
Injection site	Subcutaneous in the upper arm	

7. Tetanus toxoid

7.1 What it is

Tetanus toxoid (TT) is given to women of childbearing age to prevent neonatal tetanus. It is the same tetanus toxoid as that given to children in DPT vaccine.

When given to a woman who is or becomes pregnant, the antibodies that form in her body cross the placenta into the fetus. These antibodies protect the baby against tetanus during birth and for a few months thereafter. They also protect the woman against tetanus.

When tetanus toxoid stands for a long time the vaccine separates from the liquid and looks like fine sand at the bottom of the vial. Shaking the vial mixes the vaccine and liquid again.

7.2 How it is stored

Tetanus toxoid should be stored at a temperature between 0° C and +8° C. It should never be frozen.

7.3 When it is given

To reduce the risk of neonatal tetanus, tetanus toxoid is recommended for all women of childbearing age. Your country has a policy on when to begin immunizing women with tetanus toxoid.

7.4 The number and size of doses

Five doses are given, each of 0.5 ml.

The periods of protection provided by the different doses are indicated in the following table.

Tetanus toxoid: periods of protection

Dose	When given	Period of protection
TT1	At first contact with woman of childbearing age, or as early as possible in pregnancy.	No protection
TT2	At least 4 weeks after TT1.	3 years
TT3	At least 6 months after TT2.	5 years
TT4	At least 1 year after TT3.	10 years
TT5	At least 1 year after TT4.	All childbearing years

7.5 Where and how it is given

Tetanus toxoid is injected into the muscle of the upper arm.

7.6 Side-effects

After injection a woman may have mild pain, redness, warmth, and swelling for one to three days at the injection site. This reaction may be more common after later doses than earlier ones.

Tetanus toxoid: Administration guidelines

	Recommendation	Comment
Age	As soon as possible after a woman reaches childbearing age	Some countries count DPT doses given in childhood as part of the recommended number of TT doses.
Dose size	Usually 0.5 ml	See the manufacturer's instructions.
Number of doses	Five	Provide protection during childbearing years.
Injection site	Muscle of upper arm	

8. Summary

8.1. Immunization schedule for children

Age	Vaccines	Hepatitis B vaccine*	
		Scheme A**	Scheme B**
Birth	BCG, OPV0	HB1	
6 weeks	DPT1, OPV1	HB2	HB1
10 weeks	DPT2, OPV2		HB2
14 weeks	DPT3, OPV3	HB3	HB3
9 months	Measles Yellow fever		
* Scheme A is recommended in countries where newborns are at risk of being exposed to hepatitis B through their mothers.			
* Scheme B is recommended where this risk does not exist.			

8.2 Contraindications for immunization

There are FEW contraindications for immunization. All vaccines should be given on schedule, even when a child has a low-grade fever, a mild cold, diarrhoea or other mild illness.

If a child has diarrhoea when you give BCG vaccine, administer another dose at least four weeks later.

If a child has diarrhoea when you give OPV, administer an extra dose, i.e., a fifth dose, at least four weeks after he or she has received the last dose in the schedule.

- DPT vaccine should NOT be given to children over 5 years of age or to children who have suffered a severe reaction to a previous dose of this vaccine. Instead, a combination of diphtheria and tetanus toxoids (DT) may be given.
- Neither BCG nor yellow fever vaccines should be given to children who have signs and symptoms of AIDS.

8.3 Giving vaccines at the same time

All EPI vaccines are safe and effective when given at the same time.

- Inject them in different parts of the body.
- Do not give more than one dose of the same vaccine to a client in one session.
- Space doses of the same vaccine at least four weeks apart.

8.4 New vaccines

Some countries have included vaccines other than those described here in their national immunization programmes or may add them in the future. They include: mumps, rubella, Japanese B encephalitis, meningitis, *Haemophilus influenzae type b*, *Streptococcus pneumoniae*, typhoid fever, and cholera vaccines. Ask your supervisor which vaccines are included in your national programme.

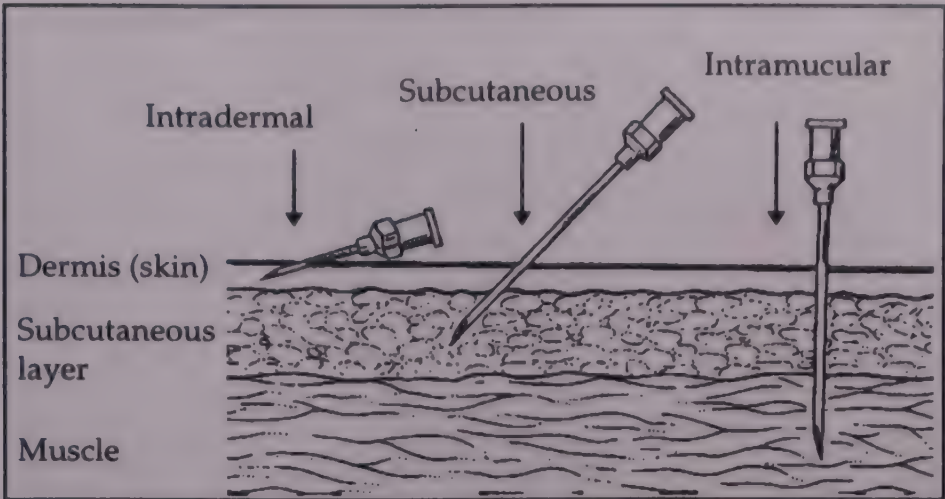
New vaccines are being studied. Research is taking place to make vaccines more stable, to combine them so that fewer injections are needed, and to make them easier to give.

8.5 Summary of injection sites

Vaccine	Kind of injection	Injection site
BCG	Intradermal	Upper left arm
DPT	Intramuscular	Outer part of thigh
OPV	Oral	Mouth
Hepatitis B	Intramuscular	Outer part of thigh
Measles	Subcutaneous	Upper left arm
Yellow fever	Subcutaneous	Upper right arm
Tetanus toxoid	Intramuscular	Upper arm

Intradermal = into the skin.
Intramuscular = into a muscle.
Subcutaneous = under the skin.

Figure 2-G: Different needle positions



Immunization in practice

Module 3:

The cold chain

- * Revision 1, issued in September 1999, revises section 4, page 12, to reflect policy changes in the handling of multi-dose vials of vaccine. These changes were initially issued as a corrigendum in April 1999: WHO/EPI/TRAM/98.01-11 Corr.1.



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva
1998*

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About this module

This module describes what the cold chain is, what vaccine storage equipment is needed in health centres, and how to use and maintain this equipment.

1. What is the cold chain?

Vaccines are sensitive to heat and must be kept cold from the time they are manufactured until they are used. The equipment and people that keep vaccines cold during their journey are together called the **cold chain**.

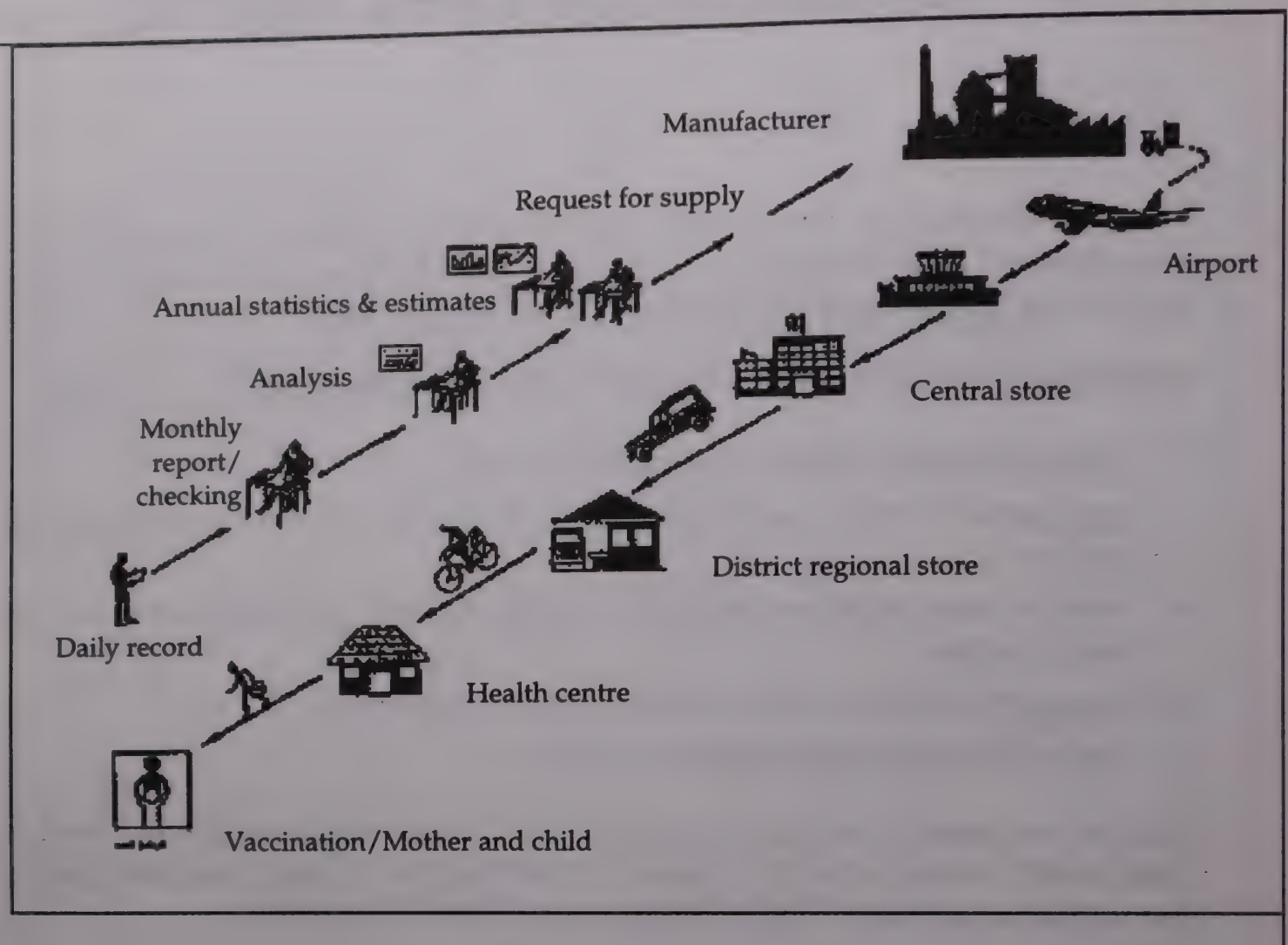
Maintenance of the cold chain requires vaccine and diluent to be:

- collected from an airport as soon as it arrives;
- transported at the correct temperature from the airport and from one store to another;
- stored at the correct temperature in central, regional and district stores and in health centres;
- transported at the correct temperature to outreach sites;
- kept cold during immunization sessions.

You are responsible for maintaining the cold chain while vaccine is stored in your health centre, while it is being transported to outreach sites, and during immunization sessions. The cold chain must **never be broken**.

The figure below illustrates the cold chain.

Figure 3-A: The cold chain



2. What cold-chain equipment is used in health centres?

Different levels of the health care system need different equipment for transporting and storing vaccine and diluent at the correct temperature.

- **Central and regional stores** need cold rooms, freezers, refrigerators and cold boxes (for transportation).
- **District stores** need freezers, refrigerators and cold boxes.
- **Health centres** need refrigerators, cold boxes and vaccine carriers.

The cold-chain equipment used in health centres includes the following:

2.1 Refrigerators

Health centre refrigerators may be powered by electricity, gas, kerosene or solar energy. Electric refrigerators are usually the least costly to run and the easiest to maintain but must have a reliable electricity supply.

Where the electricity or fuel supply is not reliable, ice-lined refrigerators can maintain the appropriate temperature for 16 hours without power if they operate with it for at least 8 hours a day.

Refrigerators have different capacities for storing vaccine and for freezing and storing ice packs. A refrigerator in a health centre should be able to hold:

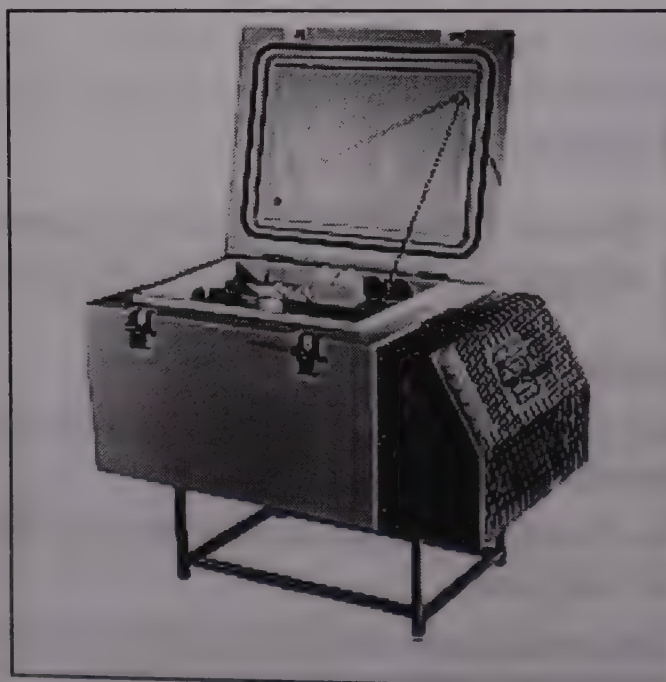
- a one-month supply of vaccines and diluent; and
- a one- to two-week reserve stock of vaccines and diluent (an additional 25-50% of the one-month supply); and
- frozen ice packs or bottles of water in the bottom of the refrigerator to keep it cool if the power fails; and
- nothing in half the total space available to allow air to circulate around the vaccines and diluent so as to keep them cool.

Figure 3-B: Two of the most common refrigerators

Absorption type refrigerator and freezer (PIS 3/28-M)



Compression refrigerator and icepack freezer (PIS E3/30)



2.2 Cold boxes

A cold box is an insulated container that can be lined with frozen ice packs to keep vaccines and diluent cold.

Cold boxes are used by health centre staff to collect and transport monthly vaccine supplies from district stores. They are also used to store vaccines when the refrigerator is out of order or being defrosted.

Different models of cold boxes have different vaccine storage capacities. Health centres usually need one or more cold boxes that can hold:

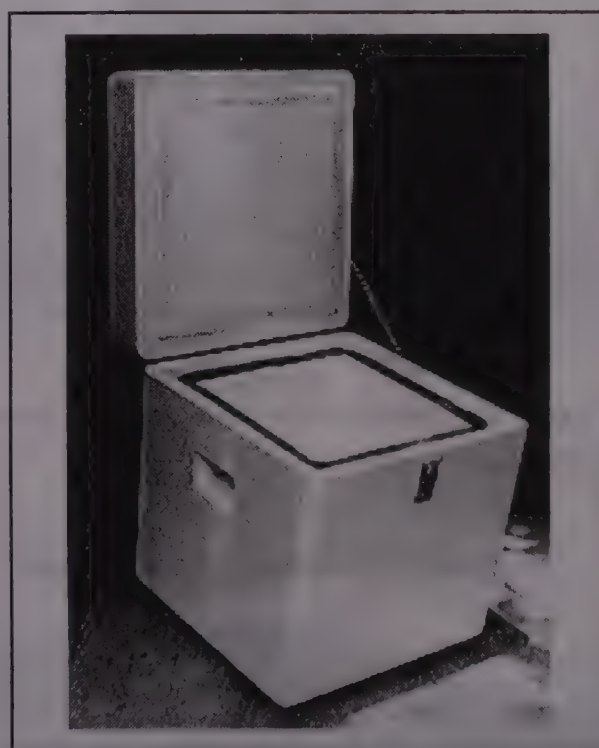
- a one-month supply of vaccines and diluent; and
- a one- to two-week reserve stock of vaccines and diluent.

In addition to their vaccine storage capacity, cold boxes are selected according to their cold life, the time taken for the temperature inside a cold box or vaccine carrier to rise from -3°C to $+10^{\circ}\text{C}$ without the lid being opened. Different models have a cold life of two to eight days.

The most suitable cold box for a particular health centre is determined by:

- the vaccine storage capacity needed;
- the cold life needed, this depending on the longest time that vaccine will be stored in the box;
- its weight, this depending on how the box will be transported, e.g., by motor vehicle or bicycle.

Figure 3-C: Small vaccine cold box



2.3 Vaccine carriers

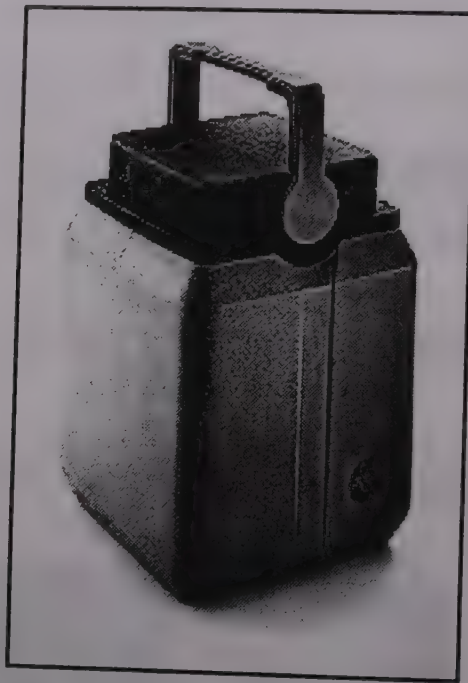
Like cold boxes, vaccine carriers are insulated containers that can be lined with frozen ice packs to keep vaccines and diluents cold. They are smaller than cold boxes and easier to carry if you are walking, but they do not stay cold as long – only for 24-72 hours.

Vaccine carriers are used to transport vaccine and diluent to outreach sites and for temporary storage during health centre immunization sessions. In small health centres they are used to transport monthly vaccine supplies from the district store. In addition they are used to store vaccines when the refrigerator is out of order or being defrosted.

Different models of vaccine carriers have different storage capacities.

The type of vaccine carrier needed in a particular health centre depends on the number of vaccine vials, diluents and ice packs to be transported, the cold life needed, and the means of transport.

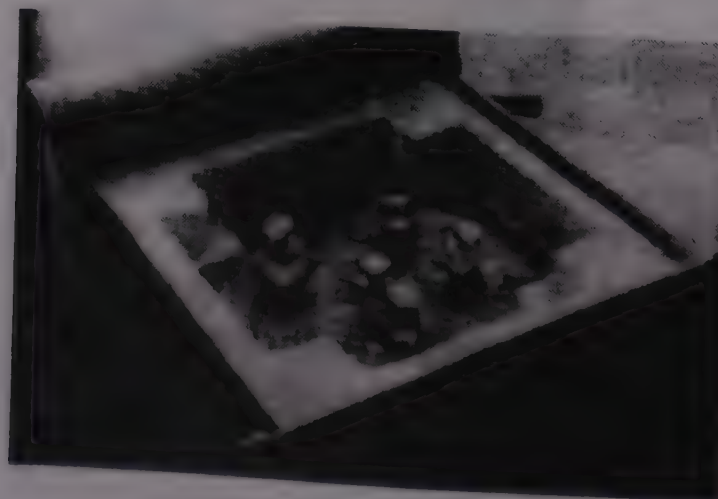
Figure 3-D: Large vaccine carriers



A **foam pad** is a piece of soft foam that fits on top of the ice packs in a vaccine carrier. When the carrier lid is open the foam pad keeps the vaccines underneath in a cool state. It also holds and protects vaccine vials during immunization sessions.

Note. Cups with ice and ice packs are no longer recommended for holding vaccine and diluent during sessions.

Figure 3-E: Foam pad in use



Do not put opened vials in the holes that are made in some ice packs. Use a foam pad.

2.4 Ice packs

Ice packs are flat, square plastic bottles that can be filled with water and frozen. The required number in a particular cold box or vaccine carrier varies.

Ice packs are available in two sizes:

- 0.6 litre for cold boxes;
- 0.4 litre for vaccine carriers.

Every health centre should have two sets of ice packs, one being frozen while the other is in use.

Figure 3-F: Icepacks



3. What cold-chain monitoring equipment is used in health centres?

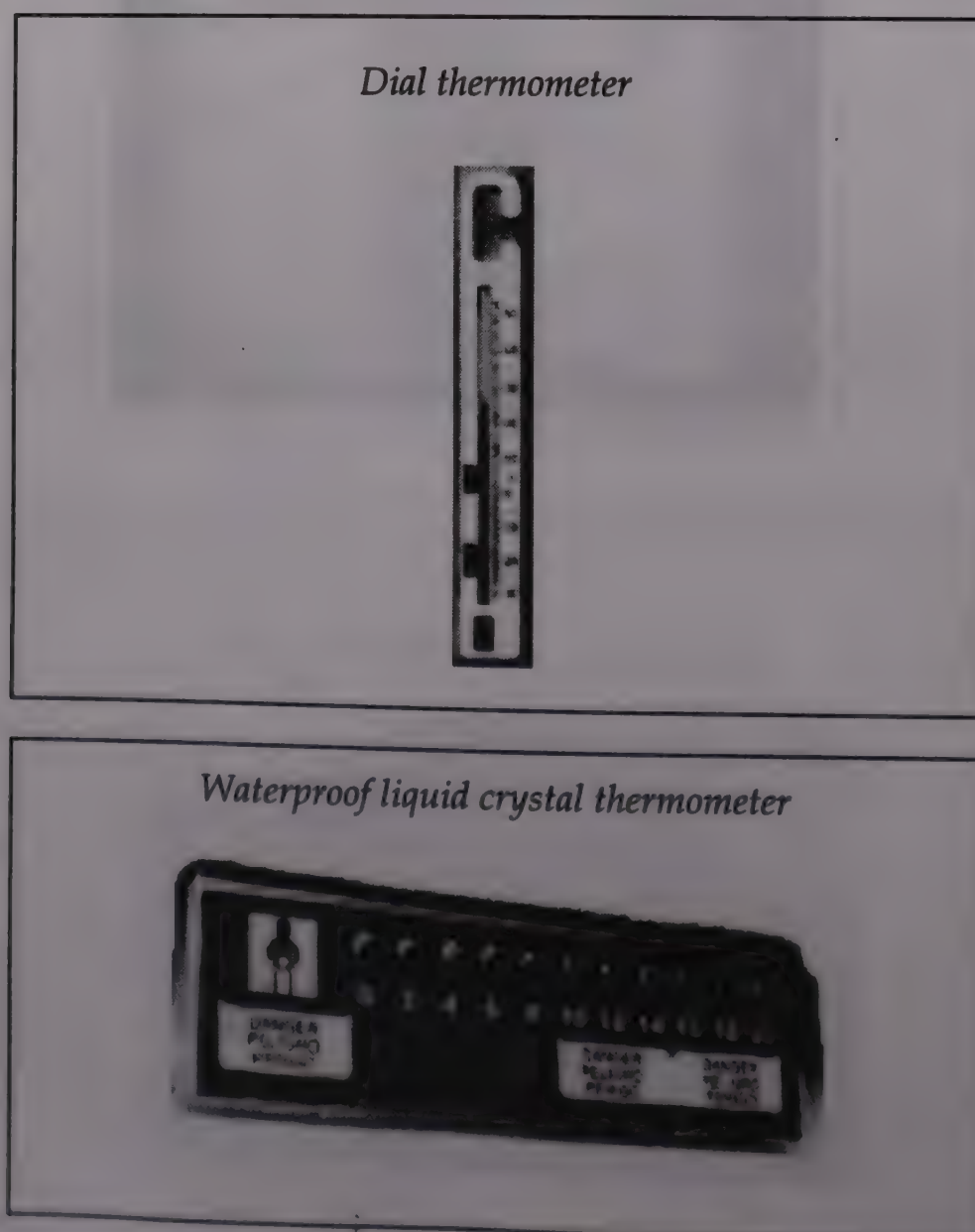
The purpose of cold-chain monitoring equipment is to keep track of the temperature to which vaccine and diluent are exposed during transportation and storage.

3.1 Thermometers

Health centre staff use dial and liquid crystal thermometers to monitor the temperature of refrigerators, cold boxes and vaccine carriers.

Liquid crystal thermometers should not be used alone in refrigerators because they do not operate at temperatures below freezing.

Figure 3-G: Thermometers



3.2 Vaccine cold-chain monitors

A vaccine cold-chain monitor is a card which changes colour when vaccine is exposed to temperatures that are too high. Health workers use them to estimate the length of time that vaccine has been exposed to high temperature.

Manufacturers pack these monitors with the BCG, DPT, polio and measles vaccines supplied by WHO/UNICEF.

Figure 3-H: Cold chain monitor card

Vaccine Cold Chain Monitor

Date in	Index	Location	Date out	Index

Keep the Cold Chain Monitor with your vaccine

When the Monitor arrives, complete the top part of the card

- Fill in the date
- Fill in the index (= A, B, C and/or D)
- Fill in the location

When the Monitor leaves, complete the top part of the card

- Fill in the date
- Fill in the index (= A, B, C and/or D)

If windows A, B, C & D are all white use vaccines normally.

If the windows A to C are completely blue, but window D is still white it means that the vaccine has been exposed to a temperature above 10°C but below 34°C for the following number of days:

	INDEX		
	A	AB	ABC
At a temperature of 12°C	3 days	8 days	14 days
At a temperature of 21°C	2 days	6 days	11 days

If window D is blue it means that there has been a break in the cold chain of a temperature higher than 34°C for a period of at least two hours. Check the cold chain.

The instruction use within three months should not be followed if either the expiry date or any local cold chain policy requires a shorter period before use or disposal of the vaccine.

Assembled & distributed by Berlinger Gerderechell Switzerland

TEST VACCINE BEFORE USE

If A all blue Use within 3 months

If B all blue Use within 3 months

If C all blue Use within 3 months

If A, B & C all blue Use within 3 months

If D all blue Use within 3 months

If D is white Use within 3 months

If D is blue Use within 3 months

SUPPLIER FOURNISSEUR

Name: _____

Date of dispatch: _____

Date of expiration: _____

Vaccine: _____

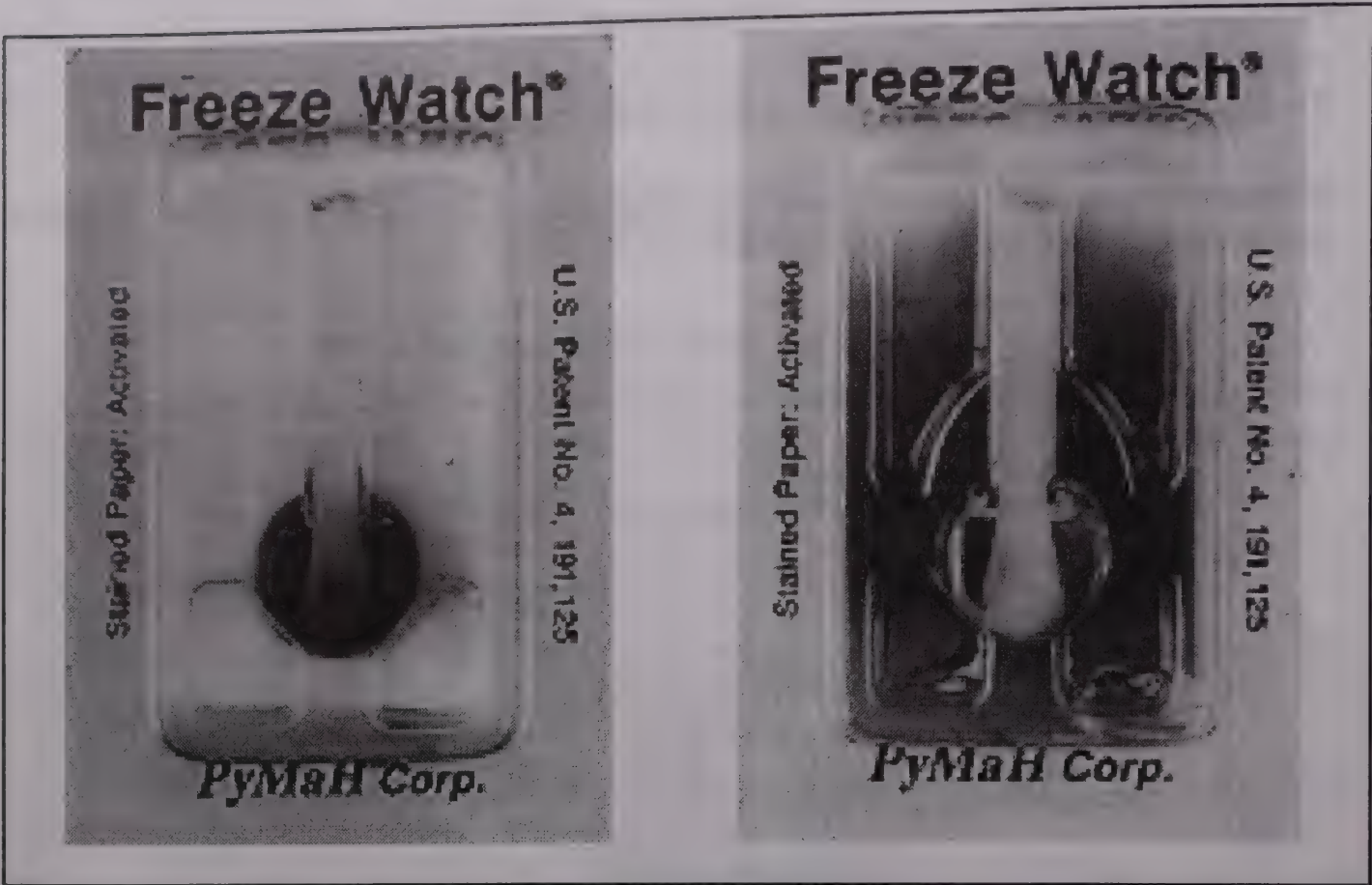
Vial: _____

3.3 Freeze watch indicators

A freeze watch indicator consists of a small vial of red liquid attached to a white card and covered in plastic. The vial breaks if the temperature where the indicator is located drops below 0° C for more than one hour, and the vaccine must then be destroyed.

Manufacturers pack temperature indicators with DT and TT vaccines to monitor them during transportation and storage.

Figure 3-I: Freezewatch indicator



3.4 STOP watch refrigerator monitors

A STOP watch monitor combines two indicators. One indicator tells you whether vaccine has been exposed to temperatures above +10° C. The other indicates whether the temperature has dropped below -4° C.

STOP watch monitors are used in vaccine refrigerators.

Figure 3-J: STOP!Watch monitor card

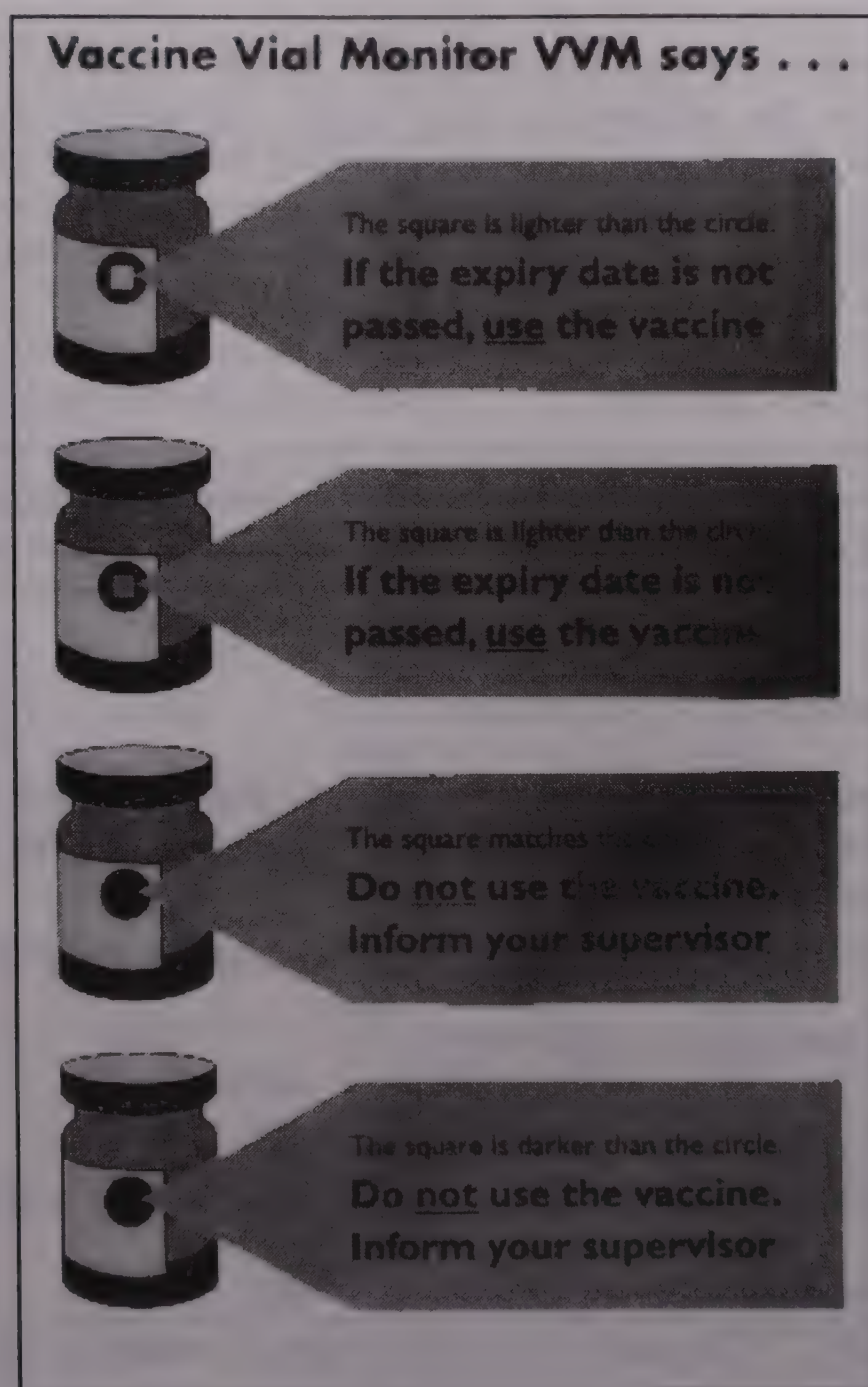


3.5 Vaccine vial monitors

A vaccine vial monitor (VVM) is a label on a vaccine vial that changes colour when exposed to heat over a period of time. Health workers check the VVM before they open a vial to see whether the vaccine has been damaged by heat.

Manufacturers attach VVMs to all OPV vials, because they are the most sensitive to heat. Eventually, VVMs will be attached to the vials of other vaccines.

Figure 3-K: Vaccine vial monitors



Each monitor (above) shows a different stage of colour change.

4. How to load cold-chain equipment

Cold-chain equipment, including refrigerators, cold boxes and vaccine carriers, must be loaded correctly to maintain the temperature of the vaccine and diluent inside.

Note. There should be one person in each health centre who has the main responsibility for the refrigerator. Her or his responsibilities should include storing vaccines, diluents and ice packs, checking and recording the temperature daily, and maintaining the centre's cold-chain equipment. However, all health workers in a health centre should know how to monitor the cold chain and what action to take if the temperature is too high or too low.

4.1 Vaccine refrigerators

Vaccines, diluents and ice packs should have their own refrigerator. Storing other supplies in a vaccine refrigerator raises its temperature.

Vaccine refrigerators have two sections:

- A main section for storing vaccines and diluents, in which the temperature should be kept between 0°C and $+8^{\circ}\text{C}$. Thermostats in this section are used to adjust the temperature.
- A freezer for freezing ice packs. This section should be kept below 0°C .

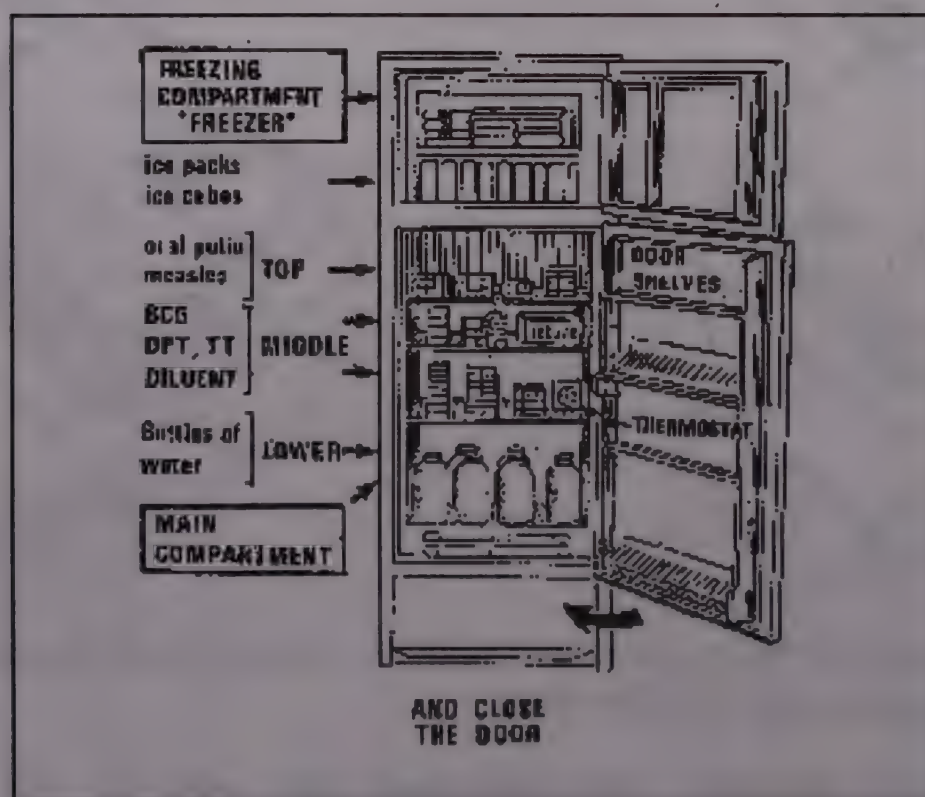
Load a vaccine refrigerator as follows:

- Freeze and store frozen ice packs in the freezer.
- Put vaccines and diluents on the top and middle shelves of the main section:
 - OPV and measles vaccine on the top shelf;
 - BCG, DPT, TT, hepatitis B and yellow fever vaccines on the middle shelves;
 - diluents next to the vaccines with which they were supplied.
- Arrange the boxes of vaccine in stacks between which the air can move.
- **Multi-dose vial policy.** Opened multi-dose vials of liquid vaccines from which one or more doses have been removed, following standard sterile

procedures, may be used in the next immunization session, *if all of the following conditions are met:*

- a) The expiry date has not passed; and
 - b) The vaccine has not been contaminated; and
 - c) The vials have been stored under appropriate cold chain conditions; and
 - d) The VVM on the vial, if attached, has not reached the discard point.
- Liquid vaccines to which the statement above applies include OPV, DPT, TT, DT, Td, hepatitis B, and liquid formulations of Hib.
 - Freeze-dried vaccines, which include BCG, measles, yellow fever, and freeze-dried formulations of Hib, must be discarded six hours after reconstitution or the end of the immunization session, whichever comes sooner.
 - Keep opened multi-dose vials of OPV, DPT, TT, DT, Td, hepatitis B, and liquid formulations of Hib that meet the conditions above in a special box in the main section of the refrigerator, so that you remember to use them first in the next session.
 - Discard opened vials of all reconstituted vaccines, including BCG, measles, and yellow fever vaccines.
 - Keep plastic bottles or ice packs filled with water on the bottom shelf. They help to keep the temperature constant.

Figure 3-L: Vaccine refrigerator



DO NOT put vaccines on the door shelves: the temperature is not low enough.

DO NOT keep expired vaccines in the refrigerator. Throw them away or return them to the district store.

DO NOT keep any food, drink or drugs in a vaccine refrigerator.

Opening the refrigerator door raises the temperature.

Before you open the door, plan what you are going to do.

When you open the door, do what you have to do quickly and close the door as soon as possible.

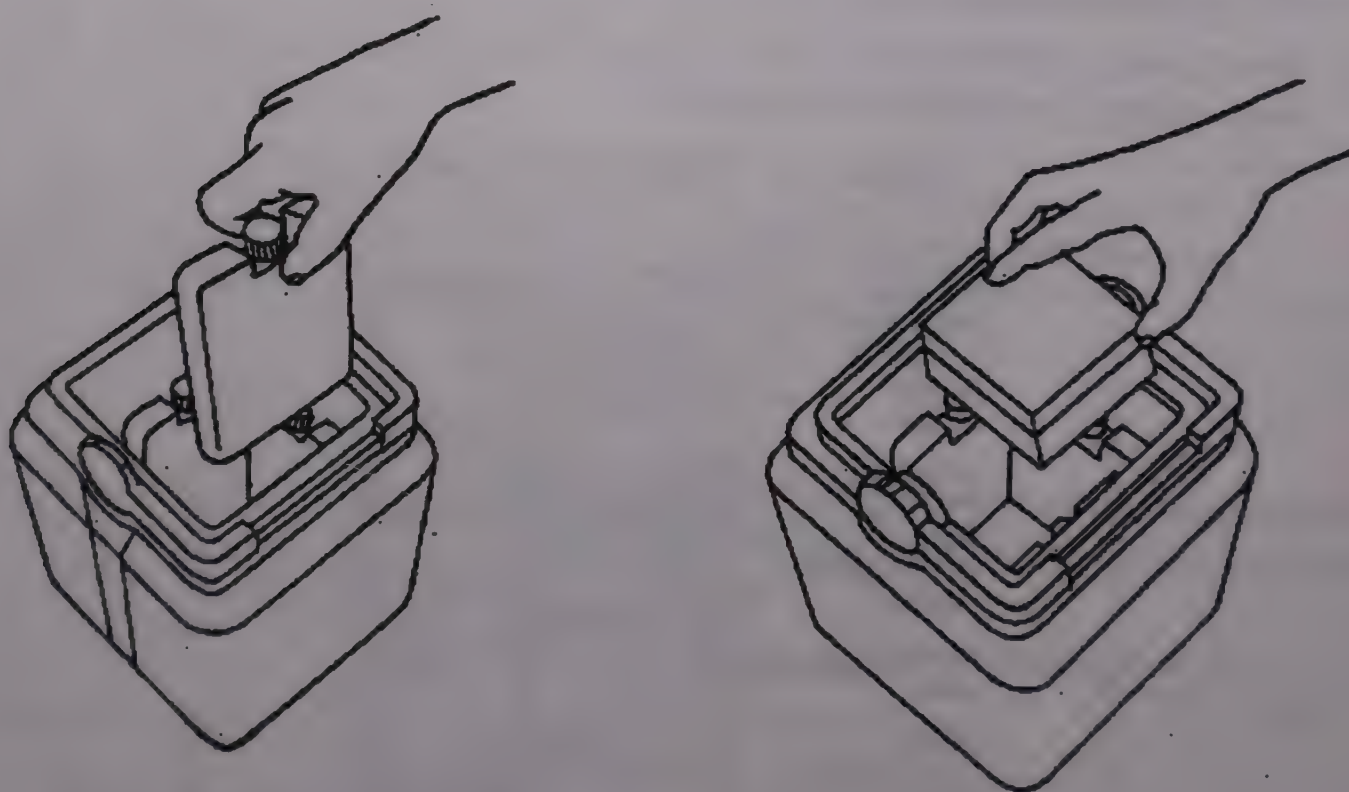
Try not to open the refrigerator door more than three times a day.

4.2 Cold boxes and vaccine carriers

Load vaccine into cold boxes and vaccine carriers as follows:

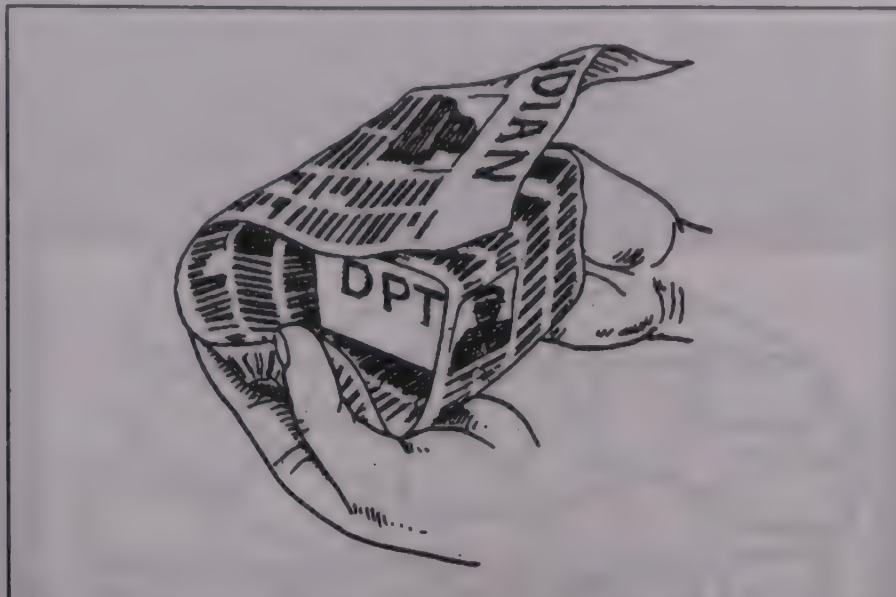
- 1) Quickly take all the frozen ice packs (see Section 5) you need from the freezer and close the door.
- 2) Put ice packs against each of the four sides of the cold box or vaccine carrier.

Figure 3-M: Arranging icepacks in a vaccine carrier



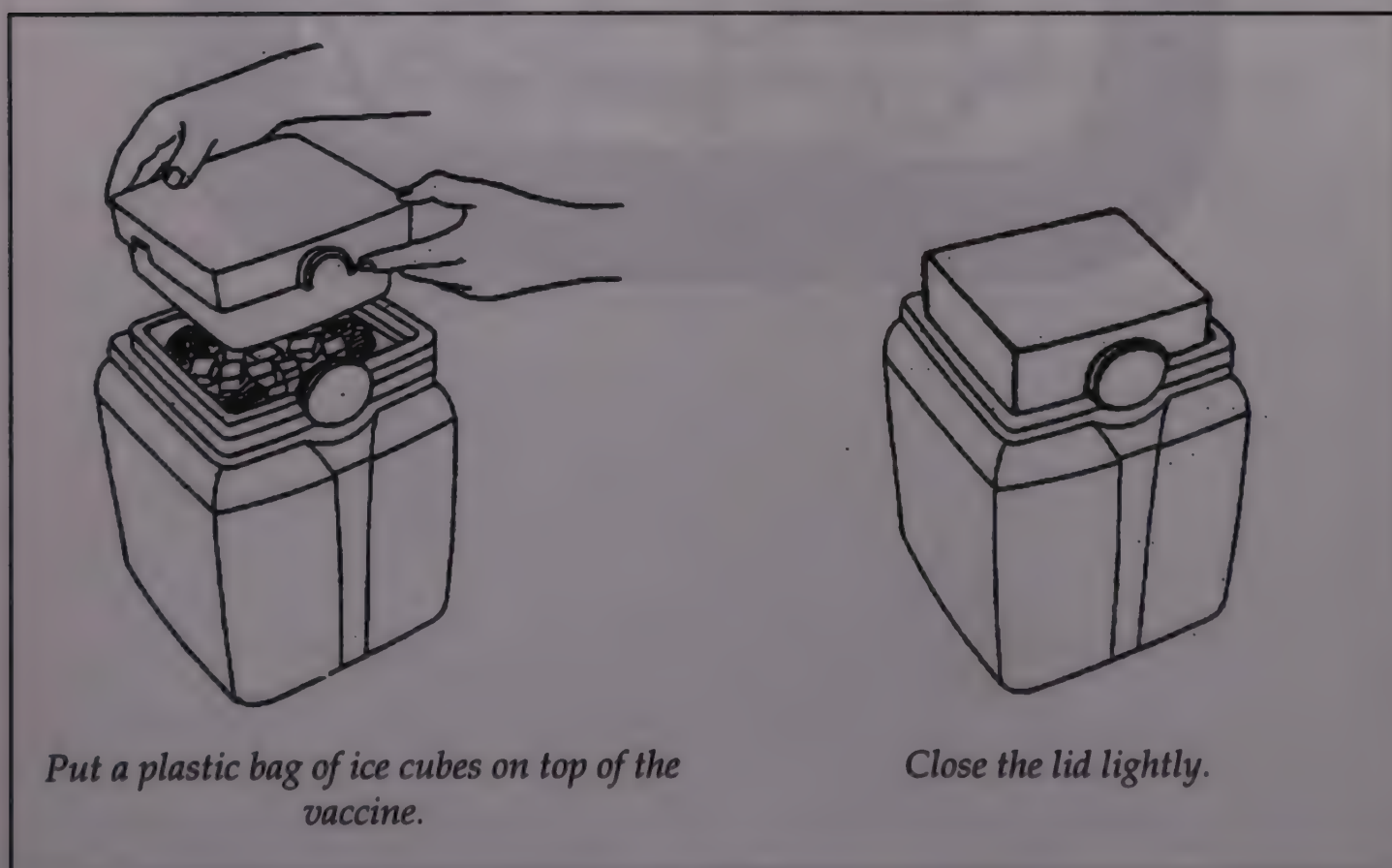
- 3) Quickly take all the vaccines and diluent you need from the main section of the refrigerator and close the door.
- 4) **For outreach sessions, take unopened vials only.** Put the vaccines and diluent in the middle of the cold box or carrier. Vials may be kept in their boxes or packed without them, depending on how many vials you need. Do not let DPT, TT or hepatitis B vaccine vials touch the ice packs. Put newspaper or cardboard around them to protect them from freezing.

Figure 3-N: Wrapping newspaper around the DPT and TT vaccines



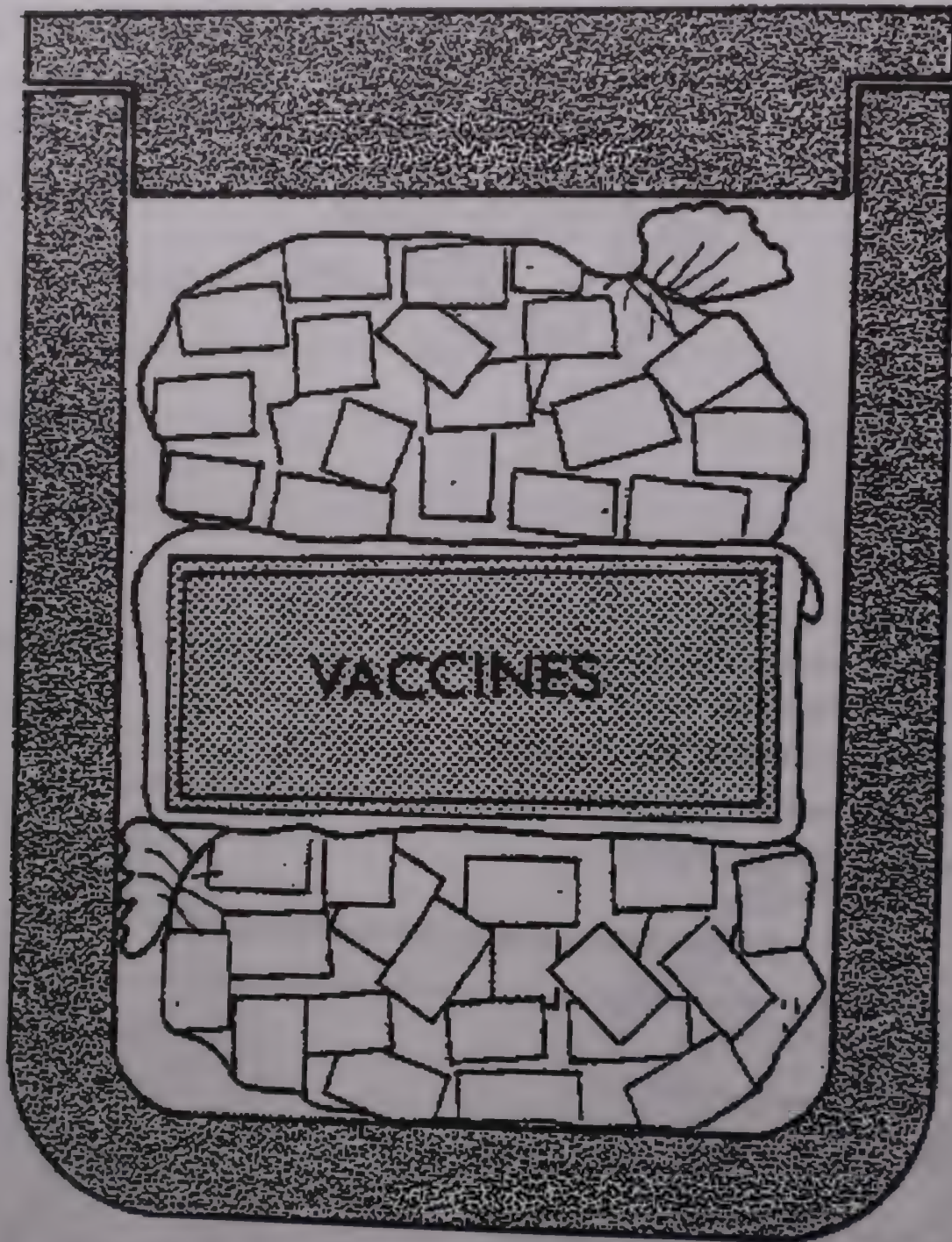
- 5) Put a thermometer on top of the vaccines unless vaccine vial monitors are attached to the vials.
- 6) Put ice packs on top of the vaccines.
- 7) For vaccine carriers, place a foam pad on top of the ice packs.
- 8) Close the carrier lid tightly.

Figure 3-O: Closing the vaccine carrier



Note. If you use ice cubes, put one plastic bag full of cubes in the bottom of the carrier and one bag full of cubes on top of the vaccines.

Figure 3-P: Vaccine carrier with ice cubes



5. Making ice packs

It takes 48 hours to freeze an ice pack.

Make ice packs as follows:

- Fill with clean cold water and put the cap on tightly.
- Hold each ice pack upside down and squeeze it to make sure that there is no leak.
- Put the ice packs upright or on their sides in the freezer and close the door.
- Leave them in the freezer for at least 48 hours to freeze solid.

Keep ice packs that do not fit in the freezer on the bottom shelf of the main section in order to keep this section cold. When you put these ice packs into the freezer they will freeze relatively quickly because the water inside will already be cold.

Remember:

- You do not have to refill ice packs every time you use them. Use the same water repeatedly.
- An ice pack melts quickly if not completely frozen. Make sure that the centre is frozen as well as the outside.

6. How to monitor and adjust the temperature

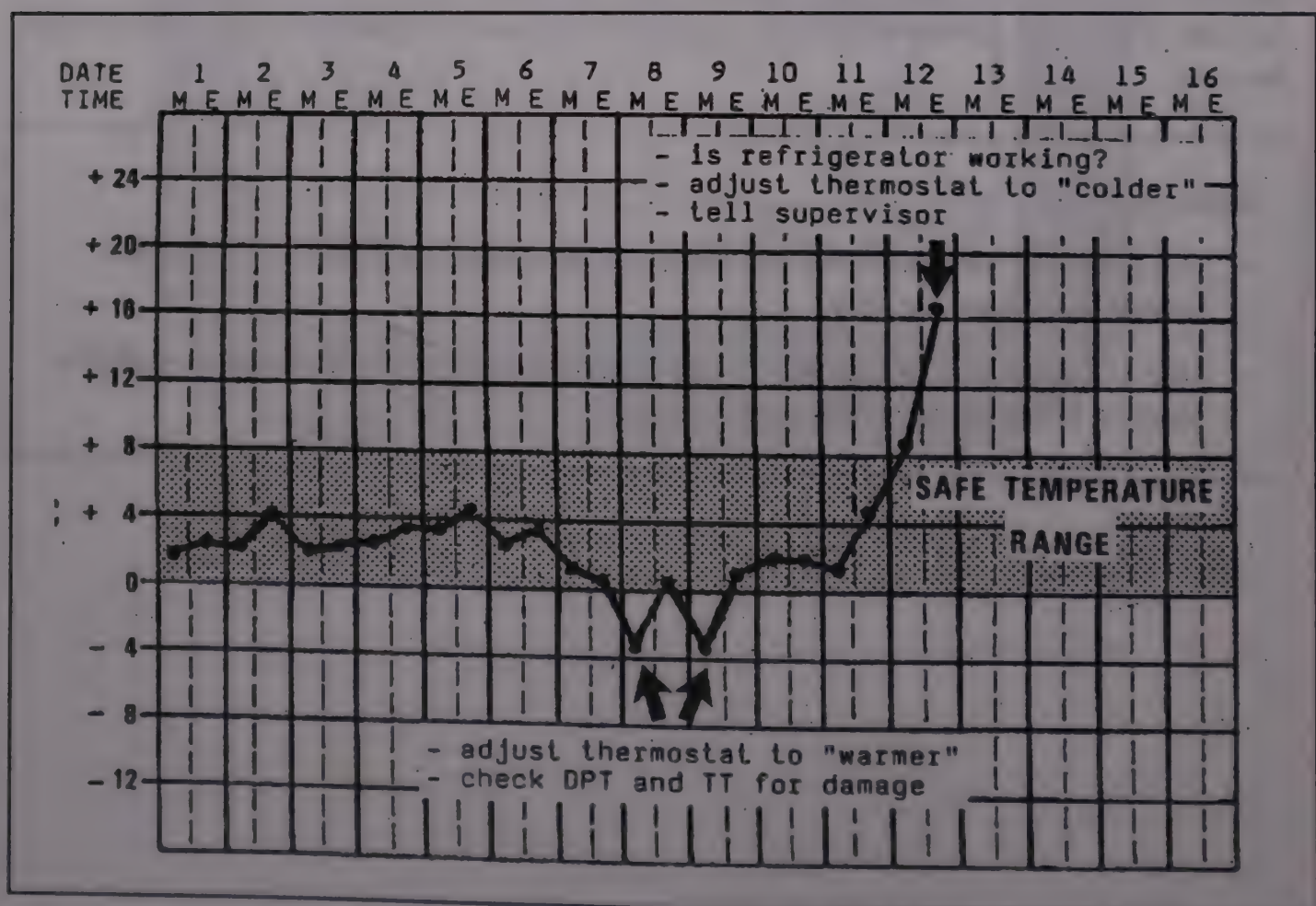
6.1 Monitoring the temperature in vaccine refrigerators

To monitor the temperature of the main section of a refrigerator you need:

- a thermometer;
- a temperature chart, which you should tape to the outside of the door.

Read the temperature on the thermometer in the main section **every** morning and afternoon, including work days, weekends and holidays. On the chart, record the temperature for the day and time, as shown below.

Figure 3Q: Refrigerator temperature chart



If the temperature is above or below the safe temperature range, adjust it if possible (see Section 6.2).

When a chart has been completed, replace it with a new one. Keep the completed charts in a record book for future reference.

6.2 How to adjust the temperature of vaccine refrigerators

If the temperature is too HIGH (above +8° C), proceed as follows:

- Make sure that the refrigerator is working; check the fuel or power supply.
- If the refrigerator is working, turn the thermostat knob so that the arrow points to a HIGHER number. This will make the refrigerator cooler.
- If the refrigerator is not working, store vaccines in an alternative place until the refrigerator is repaired.

If the temperature is too LOW (below 0° C), proceed as follows.

- Turn the thermostat knob so that the arrow points to a LOWER number. This will make the refrigerator warmer.
- Check whether the door of the freezer closes properly. The seal may be broken.
- Check DPT and TT vaccines for damage by using the shake test (see Section 8).

6.3 Maintaining the correct temperature in cold boxes and vaccine carriers

The temperature in vaccine carriers and cold boxes cannot be adjusted but you can maintain the temperature below +8° C if you keep heat out as follows:

- Keep the lid tightly on the vaccine carrier in transit.
- During immunization sessions, keep opened vials on the foam pad of your vaccine carrier. The foam pad keeps vaccines inside the carrier cool while providing a place to hold and protect vaccine vials in use.

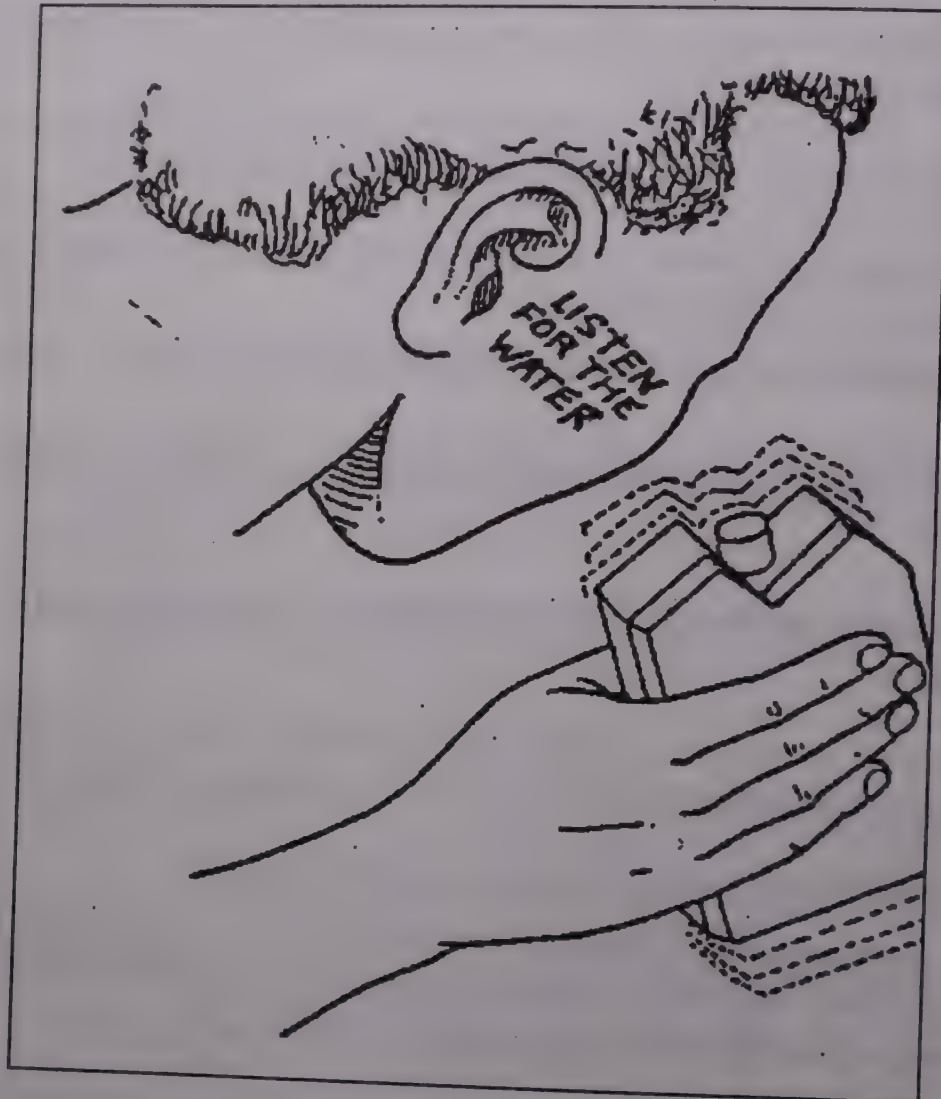
Figure 3-R: Foam pad in use



- Do not put vials back inside the carrier after each use: if you keep lifting up the foam pad the inside of the carrier will become warm.
- Keep cold boxes and vaccine carriers in the shade. Do not leave a cold box or vaccine carrier in a vehicle that is standing in the sun. Take it out of the vehicle and put it in the shade.

You can check whether you can still use vaccine by shaking an ice pack from the cold box or carrier. If you **cannot** hear water splashing, the ice pack has not melted and the vaccines are not damaged. If you **can** hear water splashing, the ice pack has melted and the vaccines are too warm and must be discarded.

Figure 3-S: Checking an icepack



Remember:

In order to maintain the temperature in cold boxes and vaccine carriers:

- Keep them in the shade;
- Keep their lids on.

7. How to maintain cold-chain equipment

7.1 Maintenance of vaccine refrigerators

A refrigerator works well only if it is cleaned and defrosted regularly.

Thick ice does NOT keep a refrigerator cool but makes it work harder and use more power or fuel. You should therefore remove ice when it becomes more than 0.5 cm thick or once a month.

To defrost and clean a refrigerator, proceed as follows:

- Take out all the vaccines, diluents and frozen ice packs and transfer them to a cold box lined with frozen ice packs.
- Turn off the power supply to the refrigerator.
- Leave the door open and wait for the ice to melt. Do not try to remove the ice with a knife or ice pick, since doing so can permanently damage the refrigerator.
- Clean the inside of the refrigerator with a cloth.
- Turn the refrigerator on again.
- When the temperature in the main section falls to +8° C or lower, return the vaccines, diluents and ice packs to their appropriate places.

If you need to defrost your refrigerator more than once a month:

- You may be opening it too often (more than three times daily); or
- The door may not be closing properly.

7.2 What to do when a vaccine refrigerator is not working

If your vaccine refrigerator stops working, first protect the vaccines and then deal with the refrigerator.

Protecting the vaccines

Move them to another place until the refrigerator is repaired. If you think that the problem will last only a short time you may use a cold box or vaccine carrier lined with frozen ice packs for temporary storage. For a longer duration, use another refrigerator.

Restoring the refrigerator to working order

- Check the power or fuel supply. If there is no power, make other arrangements until power is restored. If there is no fuel, get more fuel as soon as possible.
- If a lack of power or fuel is not the problem, repair the refrigerator or report to your repair technician or supervisor.

7.3 Maintaining cold boxes and vaccine carriers

Knocks and sunlight can cause cracks in the walls and lids of cold boxes and vaccine carriers. If this happens the vaccines inside will be exposed to heat.

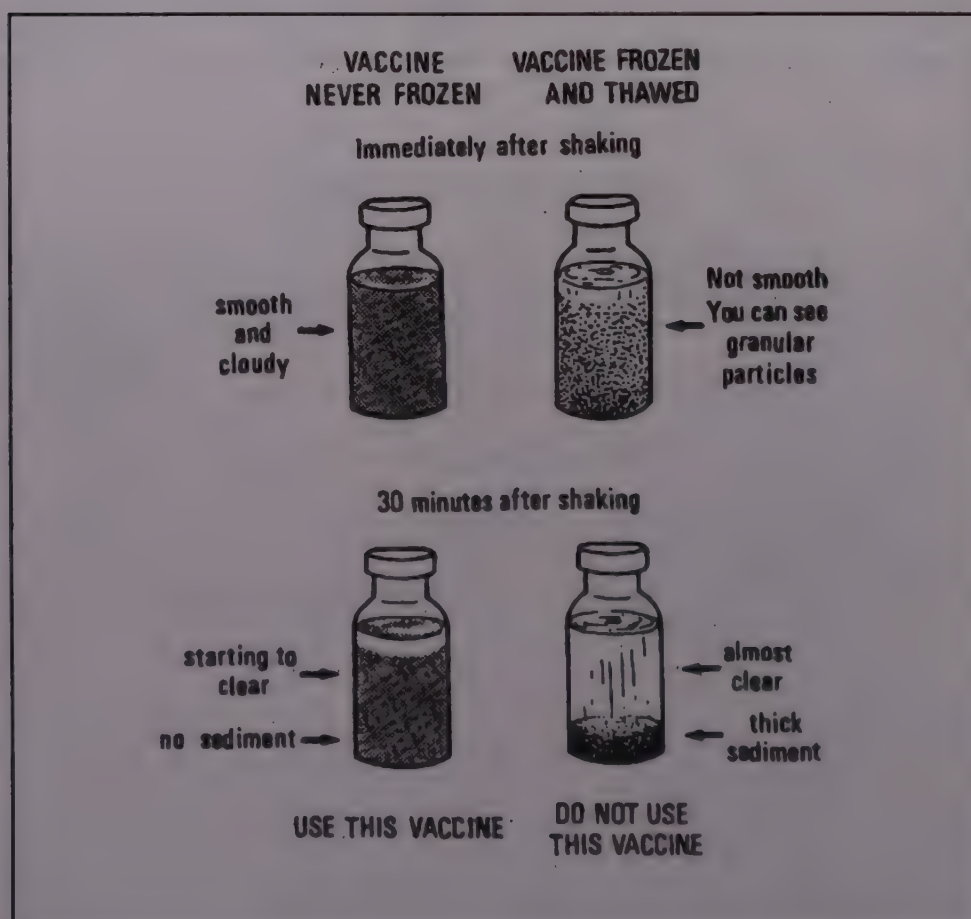
If a cold box or carrier wall has a small crack you may be able to repair it with duct tape.

8. The shake test to determine whether vaccine has been frozen

DPT, hepatitis B and tetanus toxoid vaccines can be damaged by freezing. You can find out whether this has occurred by using the shake test.

- 1) Take two DPT vials, one that you think might have been frozen and another from the same manufacturer which you **KNOW** has never been frozen.
- 2) Shake both vials.
- 3) Look at the vaccine inside the two vials (see figure 3-T).
- 4) Let the sediment settle for 15-30 minutes.
- 5) Again look at the vaccine inside the two vials (see figure 3-T).

Figure 3-T: Shake test - to check if DPT or TT vaccine has been damaged



If a vial fails the shake test, dispose of it.

Remember:

- Vaccines are damaged by heat whether they are exposed to a lot of heat in a short time (e.g., as a result of keeping vaccine in a closed vehicle in the sun) or a small amount of heat over a long period (e.g., as a result of the frequent opening of a refrigerator door).
- Maintaining the cold chain demands constant vigilance.

9. Summary

The tables below show the sensitivity of different vaccines to heat and freezing:

Sensitivity to heat

Range	Vaccine before reconstitution	Vaccine after reconstitution
Most sensitive	OPV	BCG
	Measles	OPV
	Yellow fever	Measles
	Hepatitis B	Yellow fever
	DPT	Hepatitis B
	BCG	DPT
Least sensitive	TT	TT

Sensitivity to freezing

Vaccines damaged by freezing	Vaccines that can be frozen without harm
Hepatitis B	BCG
DPT	OPV
TT	Measles
	Yellow fever

Immunization in practice

Module 4:

Ensuring safe injections



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva
1998*

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About this module

An injection should be given only if necessary, and every injection must be safe. An injection is safe:

- for the *client*, when a sterile syringe and a sterile needle and appropriate injection techniques are used;
- for the *health worker*, when he or she avoids needle-stick injuries;
- for the *community*, when used injection equipment is disposed of correctly.

This module describes how to ensure safe injections, and the equipment you need and the procedures you must follow in cleaning, sterilizing, handling and disposing of injection equipment.

1. Injection equipment

1.1 Types of injection equipment

The following equipment can be used to administer injectable vaccines:

- single-use syringes and needles;
- sterilizable syringes and needles;
- prefilled syringes.

Single-use syringes and needles

Single-use syringes and needles are appropriate for all types of immunization strategies, including use in fixed clinics and in outreach and special campaigns. They are recommended for use where sterilization of reusable injection equipment cannot be guaranteed. A sterile packed syringe and a sterile packed needle must be used for each injection and they must be destroyed immediately after use. There are two types of single-use syringes and needles: **standard disposable** and **autodestruct**.

Standard disposable syringes and needles can be used for immunization only in settings where it is guaranteed that they will be destroyed after a single use, as verified by monitoring of consumption and supervision of disposal. Their reuse places the general public at high risk of disease and death.

Autodestruct syringes are designed so that it is **impossible** to use them more than once. Consequently they present the lowest risk of person-to-person transmission of blood-borne pathogens. They are the preferred type of disposable equipment for administering vaccines, particularly in mass immunization programmes.

Single-use syringes and needles should be used **only** where they can be safely disposed of after use.

Sterilizable syringes and needles

Sterilizable syringes can be used in routine immunization sessions where compliance with cleaning and sterilization procedures between each use can be assured, as verified by supervisory visits and routine use of time, steam and temperature monitors. They are neither practical nor economical for mass immunization sessions and should not be used for this purpose. A sterile syringe and a sterile needle must be used for each injection.

A reusable syringe lasts for 50 to 200 sterilizations, depending on the hardness of the water used. Reusable needles have an average life span of 50 sterilizations.

Reusable equipment is most appropriate for use in fixed immunization clinics in which 30 to 120 injections are given in a day.

Immediately after use the syringes and needles must be flushed with clean water, soaked in clean water, and carefully cleaned by the end of the session. Then they must be steam sterilized for 20 minutes at a temperature between 121° C and 126° C.

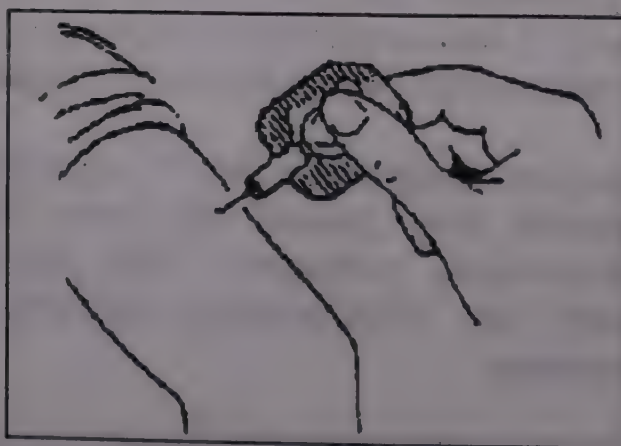
Reusable syringes and needles should be used only if their sterility can be guaranteed. This means that you must have the appropriate sterilization equipment in good working condition and that it must be correctly used.

Prefilled syringes

Prefilled syringes are single-dose packets of vaccine to which a needle has been fixed by the manufacturer. This type of injection equipment can be used only once.

Every prefilled syringe and needle is sterilized and sealed in its own foil package by the manufacturer. Just before an injection, the health worker removes the foil and the cap that covers the needle. After the injection, the used syringe and needle must be disposed of safely.

Figure 4-A: Prefilled syringe



The first EPI vaccines to be available in prefilled syringes will probably be hepatitis B vaccine and tetanus toxoid.

1.2 Sizes of syringes and needles

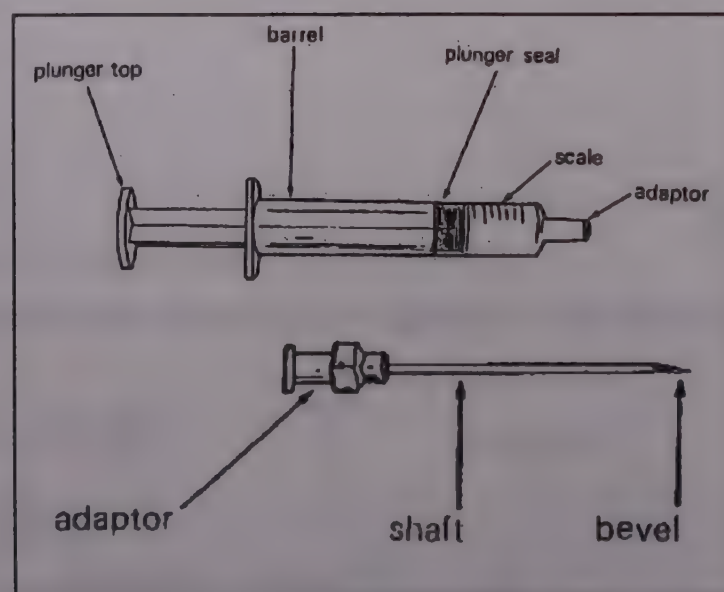
Different sizes of syringes and needles are needed for different uses.

Use	Syringe size	Needle size
BCG (for intradermal injections)	0.1 ml	Reusable 10 mm, 26 gauge Single-use 10 mm, 27 or 28 gauge
All other EPI vaccines (for intramuscular or subcutaneous injections)	1.0 ml	Reusable 25 mm, 22 gauge Single-use 25 mm, 23 gauge
Reconstitution	5.0 ml	76 mm, 18 gauge

1.3 Parts of a syringe and needle

Reusable and disposable syringes and needles have the same parts. It is important to know what these parts are called in order to handle the equipment safely.

Figure 4-B: Parts of a needle and syringe



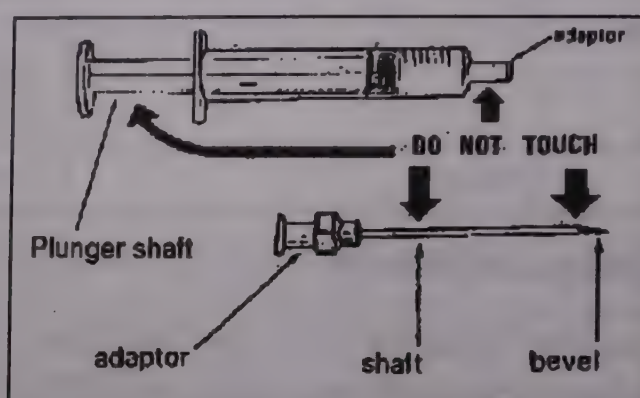
1.4 Handling syringes and needles safely

You have to hold a syringe to give an injection. Because any part of the syringe that you touch becomes contaminated, you should not touch parts that come into contact with the vaccine you are injecting or with the patient.

Do not touch:

- the shaft of the needle;
- the bevel of the needle;
- the adaptor of the needle;
- the adaptor of the syringe;
- the plunger seal of the syringe;
- the plunger shaft of the syringe.

Figure 4-C: Parts of a syringe and needle which must not be touched

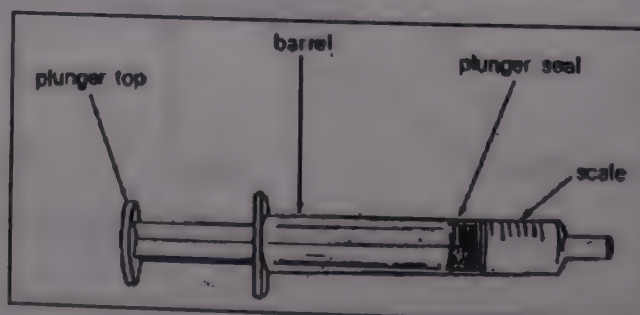


If you touch any of these parts by accident, discard the syringe and needle and get new sterile ones.

You may touch:

- the barrel;
- the plunger top.

Figure 4-D: parts of a syringe and needle which may be touched



2. Soaking, cleaning and sterilizing reusable syringes and needles

When injection equipment is sterilized, all microorganisms and spores on it are killed. If unsterile syringes and needles are used they can cause infections.

Whereas **single-use** syringes and needles are packed and sterilized by their manufacturers, **reusable** ones are not and must be sterilized before they are first used and after every use.

When reusable injection equipment is used, touched, put on an unsterile surface, or exposed to contamination in any other way, it must be flushed, soaked, cleaned and sterilized. To do this safely, you must have the right equipment and follow procedures carefully.

2.1 Equipment

The equipment you need for flushing, soaking, cleaning and sterilizing injection equipment includes:

- a washbasin;
- forceps;
- a steam sterilizer;
- a time, steam and temperature (TST) indicator;
- a hard water pad;
- a timer;
- a stove, fuel and matches.

Washbasin

This is a plastic container for soaking syringes and needles immediately after use and for cleaning them before sterilization.

Figure 4-E: Washbasin with needles and syringes soaking

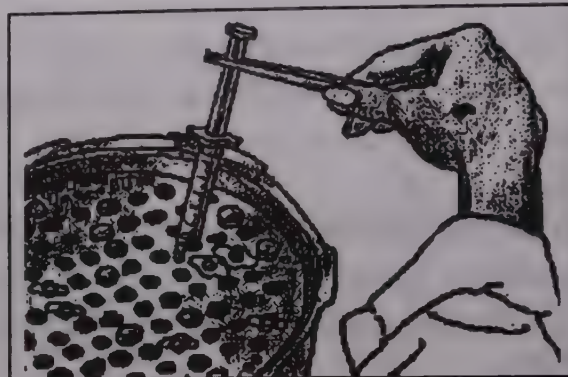


Forceps

Forceps are needed for lifting syringes, needles and other equipment from washbasins and steam sterilizers and for assembling syringes and needles after sterilization.

You need two sterilized forceps so that if one is contaminated you still have one that is sterilized.

Figure 4-F: Forceps in use



Steam sterilizer

This is a portable lightweight sterilizer similar to a domestic pressure cooker but specifically designed for immunization programmes.

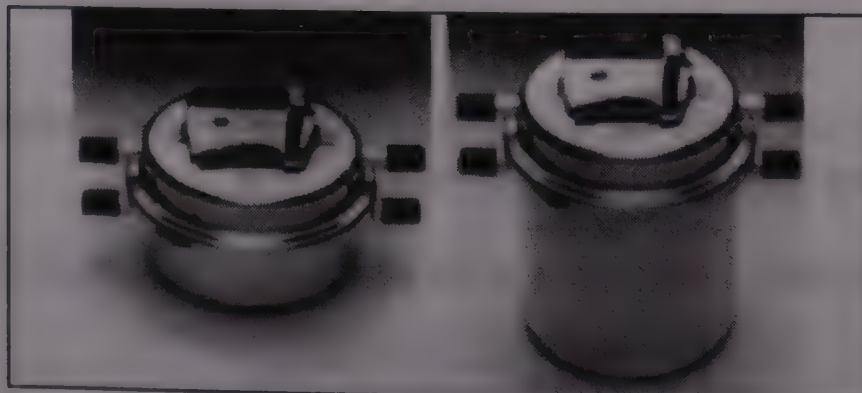
Steam sterilizers are available in three sizes:

single rack - holds 40 to 42 syringes and 50 needles of all sizes;

double rack - holds twice as many syringes and needles as a single rack;

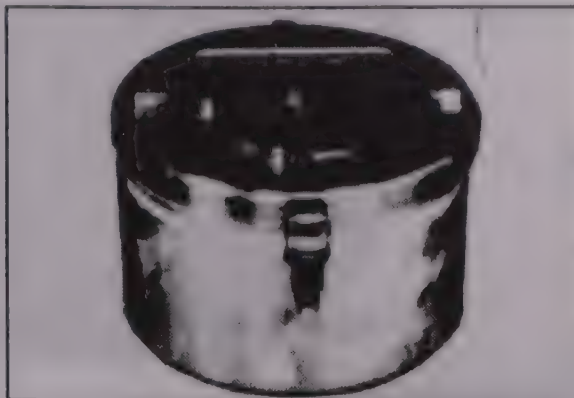
triple rack - holds three times more than a single rack.

Figure 4-G: Single- and double-rack sterilizers



Sterilizer drums are sometimes used instead of racks. After sterilization the drums can be sealed so that the drums and their sterile contents can be carried to immunization sessions without the sterilizer.

Figure 4-H: Sterilizer drum

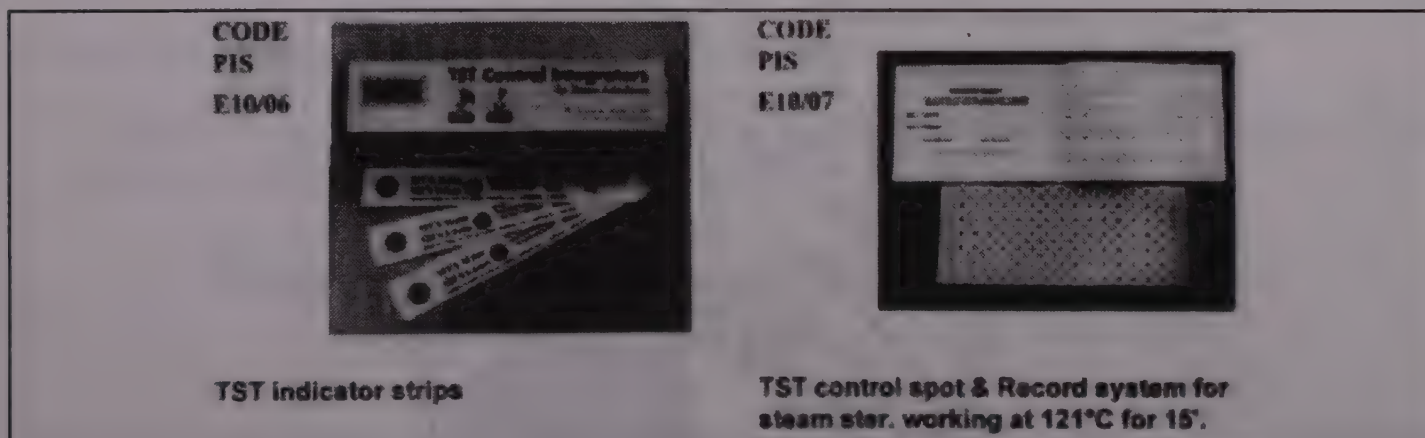


Time, steam and temperature (TST) indicator

This device is placed in a sterilizer and changes colour when the contents have been sterilized.

TST indicators are in the form of paper strips or dots.

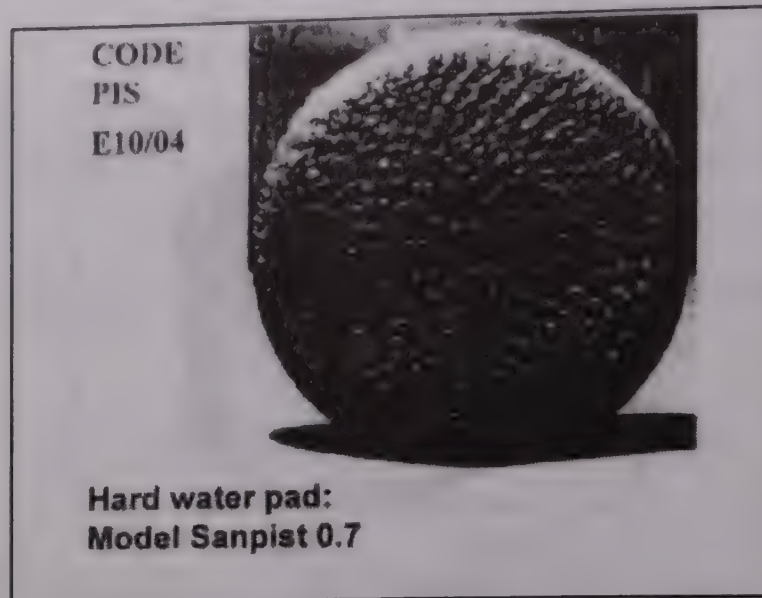
Figure 4-I: Strip and control dots



Hard water pad

This is a wire mesh pad that can be put in a sterilizer to soften the water. Soft water extends the life of reusable syringes and needles.

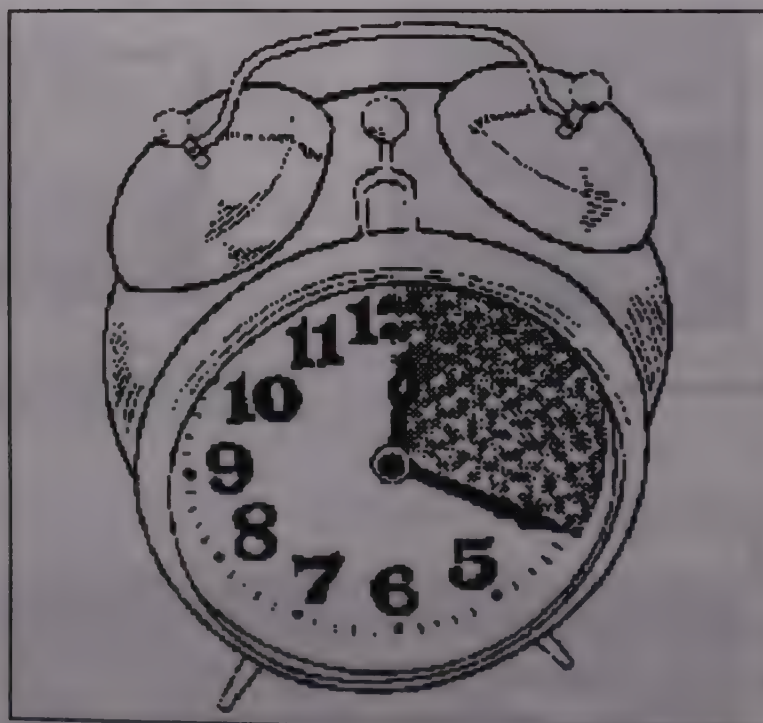
Figure 4-J: Hard water pad



Timer

A timer is used to ensure that the correct time (20 minutes) is allowed for sterilization.

Figure 4-K: Timer



Stove, fuel and matches

A steam sterilizer can be heated with a kerosene stove, gas burner, electric heating element, wood stove or charcoal stove.

Figure 4-L: Kerosene stove



2.2 Procedures for flushing, soaking and cleaning reusable syringes and needles

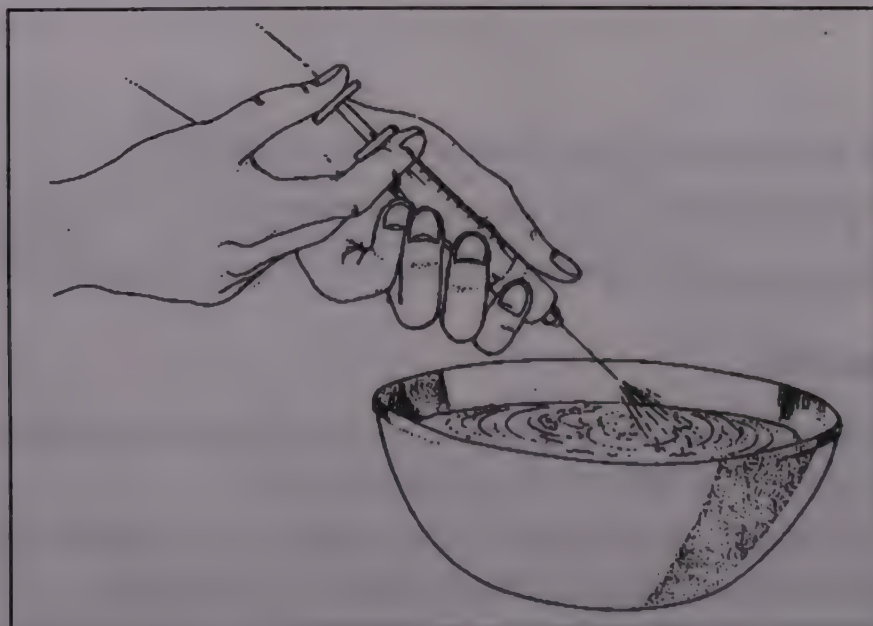
Before sterilizing reusable syringes and needles, you must flush, soak and clean them and make sure they are working properly.

You need a washbasin that you use only for this purpose. You also need forceps with which to manipulate the syringes and needles, and clean cold water. Do not use soap or disinfectant for soaking or cleaning.

Flush the syringes and needles immediately

- Immediately after use, flush needles and syringes with cold water. This prevents the needles from becoming blocked.

Figure 4-M: Flushing a syringe and needle with water



Soak the syringes and needles

- Put the syringe and needle in the washbasin without taking them apart. Soaking used syringes and needles in cold water makes them easier to clean.

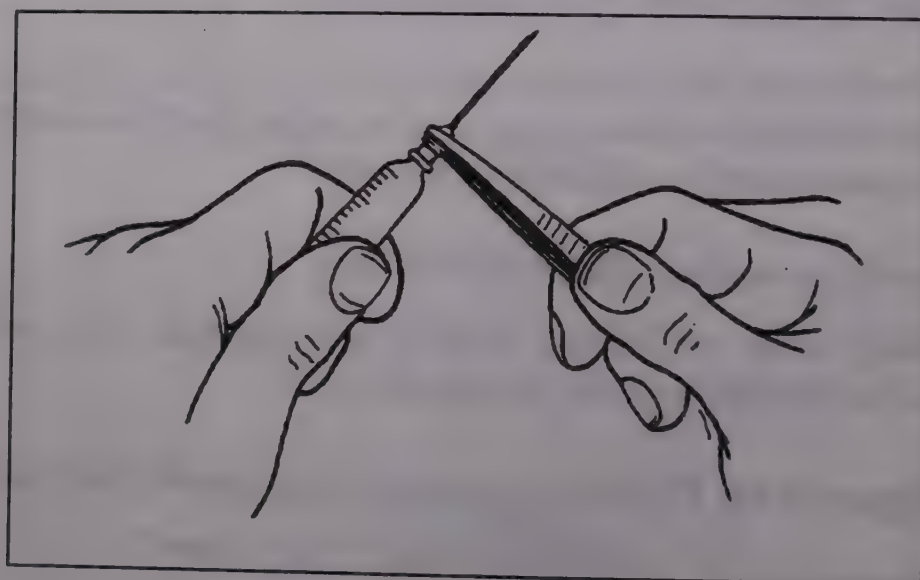
- To prevent needle-stick injuries, lay the syringes side-by-side in the washbasin, with all the needles pointing in the same direction.
- If you are planning to sterilize syringes and needles within two hours after use you do not have to soak them before cleaning.

Clean the syringes

Cleaning removes most microorganisms and contamination.

- Just before sterilizing, pour away the water in which the syringes and needles have been soaking and refill the washbasin with clean water.
- Before taking the syringe apart, make sure that the plunger seal fits inside the barrel properly. It should be tight but not so tight that it cannot move.
- Using forceps, separate the needle from the syringe. Leave the needle in the washbasin until you are ready to clean it.

Figure 4-N: Separating needle and syringe with forceps



- Flush the syringe with the water in the washbasin.
- Take the plunger out of the barrel and rinse both in the washbasin.
- Check the parts of the syringe as described in Section 5) below.

Clean the needles

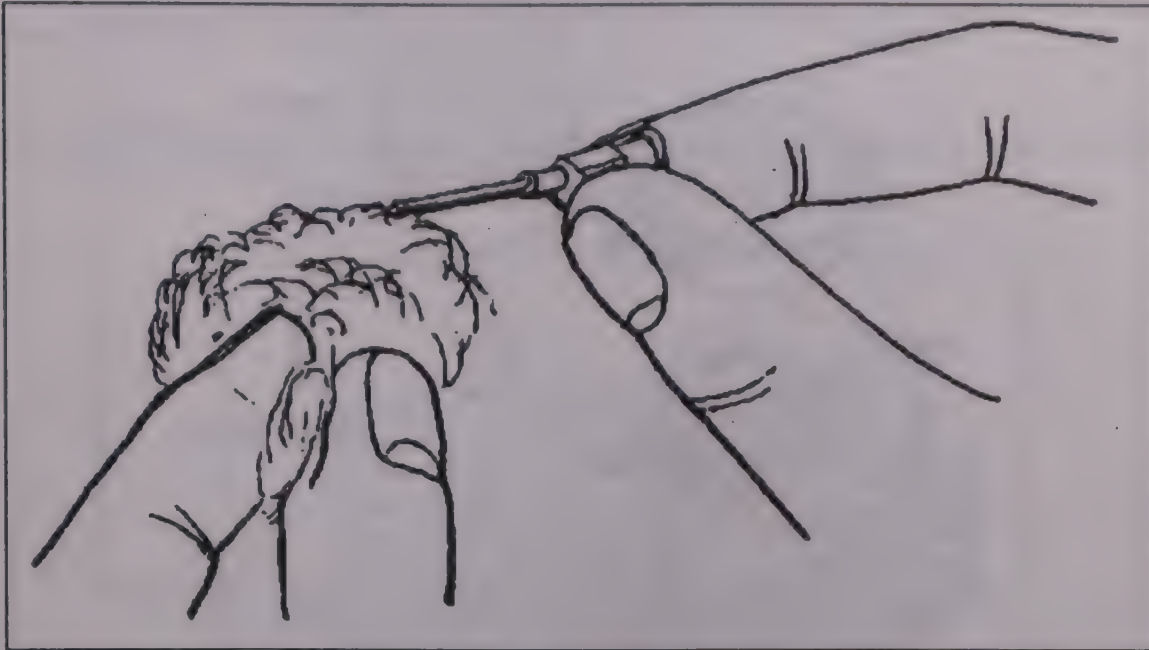
- Take a clean 5 ml syringe, attach a needle from the washbasin and flush clean water in and out of the needle several times.
- If water does not go through the needle, it is blocked. Put it in a puncture-proof container and dispose of it properly (see below).

Make sure that the syringes and needles are working properly

Check the syringes and needles before loading them into the sterilizer.

- Make sure that you can read the scale on each syringe.
- Test each needle for barbs by drawing it carefully across some cotton wool or gauze. If the needle is barbed it will catch in the cotton wool or gauze.

Figure 4-O: Testing for a barb



- Put barbed needles in a puncture-proof container for disposal. An injection with a barbed needle is painful; it also damages tissues and causes infection.

Never test a needle for barbs with your finger or on your skin.

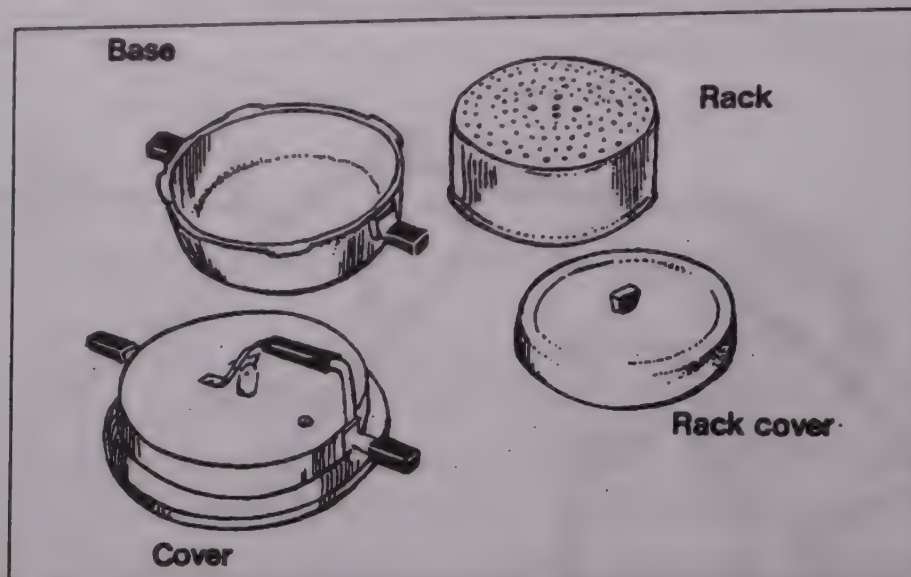
Never give an injection with a barbed needle.

2.3 Procedures for sterilizing injection equipment

A steam sterilizer has four parts:

- the base;
- the lid, which fits on the base;
- the rack or drum, which holds syringes and needles ;
- the rack or drum lid, which fits on the rack or drum.

Figure 4-P: Parts of a sterilizer, including drum



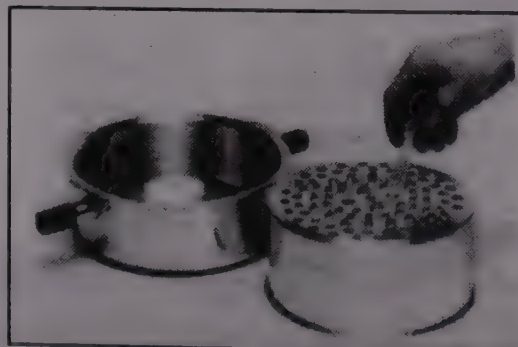
Note. Steam sterilizers from different manufacturers differ slightly from one another. See the instructions that come with your sterilizer for specific information.

Load the sterilizer

Whether you use a drum or a rack, follow the steps below for loading.

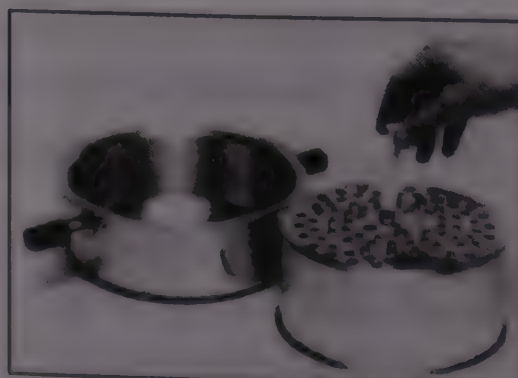
- Put the barrels of the syringes in the largest holes in the rack or drum.

Figure 4-Q: Putting barrels into the largest holes



- Put the plungers into the medium-sized holes. The medium-sized holes have raised edges.

Figure 4-R: Putting plungers into medium-sized holes



- **Put needles, points downwards, into the smallest holes:** Hold each needle in one hand at an angle and tip it into a hole. Do NOT put your fingers around the hole to guide the needle.

Figure 4-S: Putting a needle into a small hole, showing the needle at an angle, not straight up and down

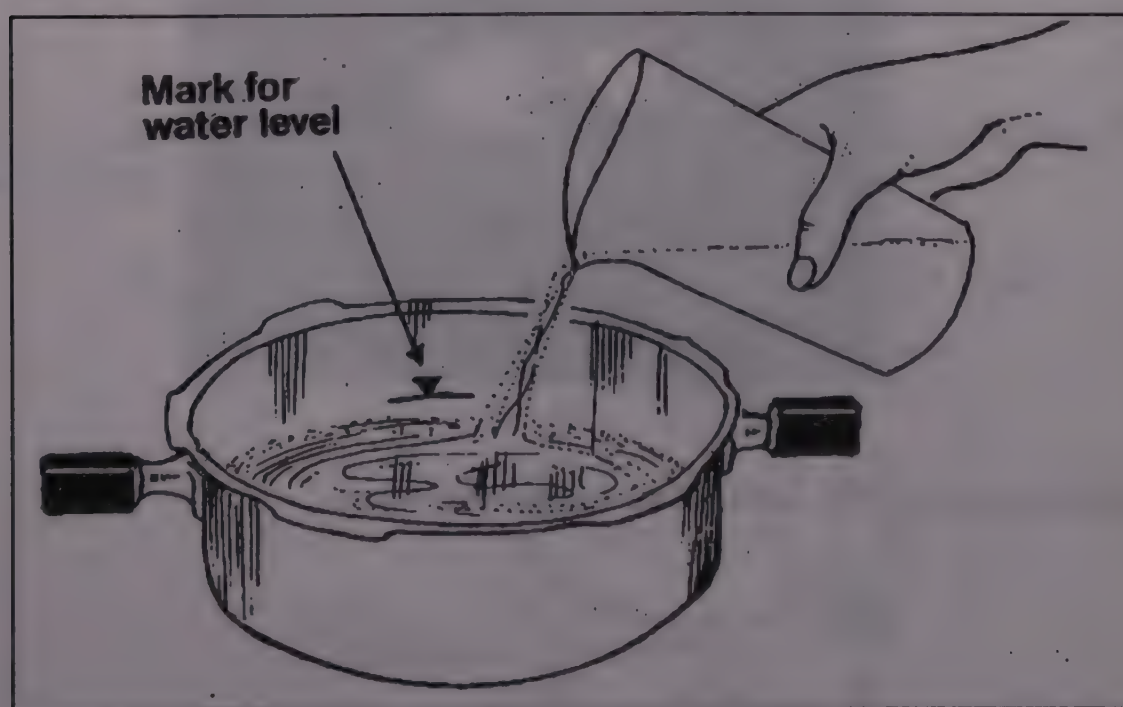


- Be careful not to jab the point of the needle against the rack or drum when you put the needle into the hole.

To make assembly after sterilization easier, place:

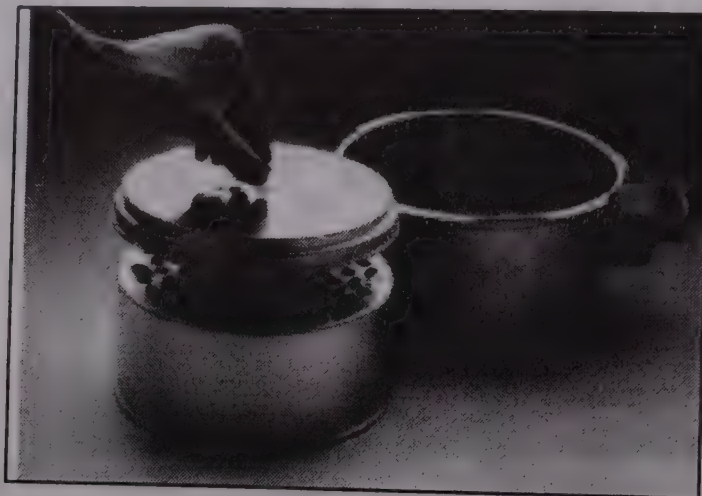
- BCG needles near BCG syringes;
 - DPT, measles and TT needles near 1 ml syringes;
 - mixing needles near 5 ml syringes.
- **Put water into the sterilizer base.** Fill water up to the mark on the inside of the base. If you are using a hard water pad, place it in the water.

Figure 4-T: Putting water into the sterilizer base



- **Put a TST indicator on the rack or drum.:** Put a TST indicator on top of the syringes and needles in the rack or drum.
- **Put the rack or drum lid on the rack or drum:** If you are using a drum, make sure that the vents are open before putting the lid on. (After sterilization, when you remove the drum from the base, you close these vents.)
- **Squeeze the clip on the handle of the lid so that it fits into the hole in the rack or drum.**

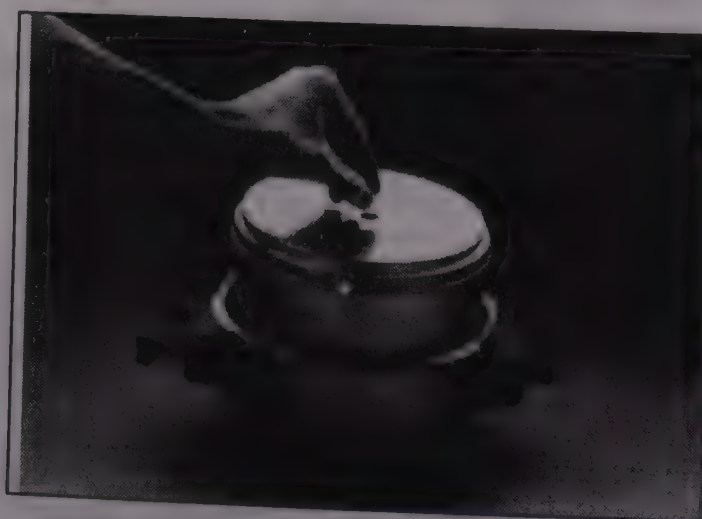
Figure 4-U: Putting lid on rack



Note. If you are using a double- or triple-rack sterilizer, put a lid on each rack.

- **Put the rack or drum in the sterilizer base.**

Figure 4-V: Putting the rack in the sterilizer base



- **Put the forceps on the rack lid or inside the drum.**

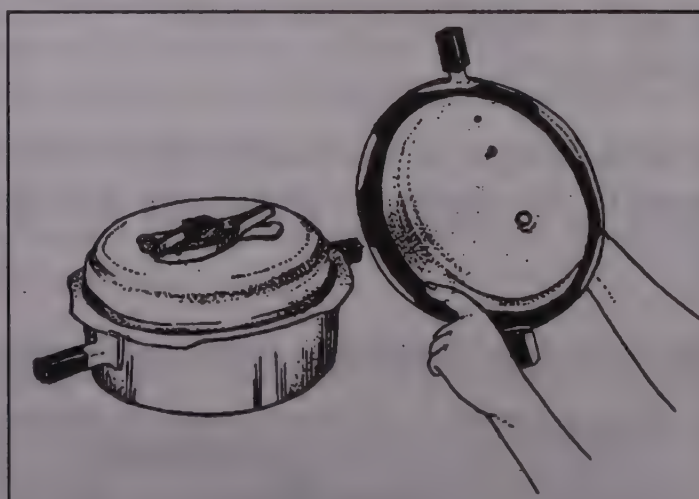
Figure 4-W: Forceps on rack lid



Note. If you are using a double- or triple-rack sterilizer, put forceps on the top rack lid only.

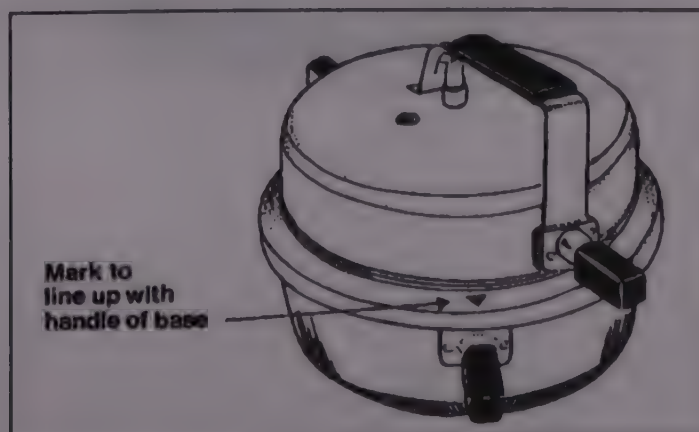
- **Check the rubber seal on the sterilizer lid:** Make sure that the rubber seal is in place and that it is in good condition.

Figure 4-X: Checking the rubber seal on the sterilizer



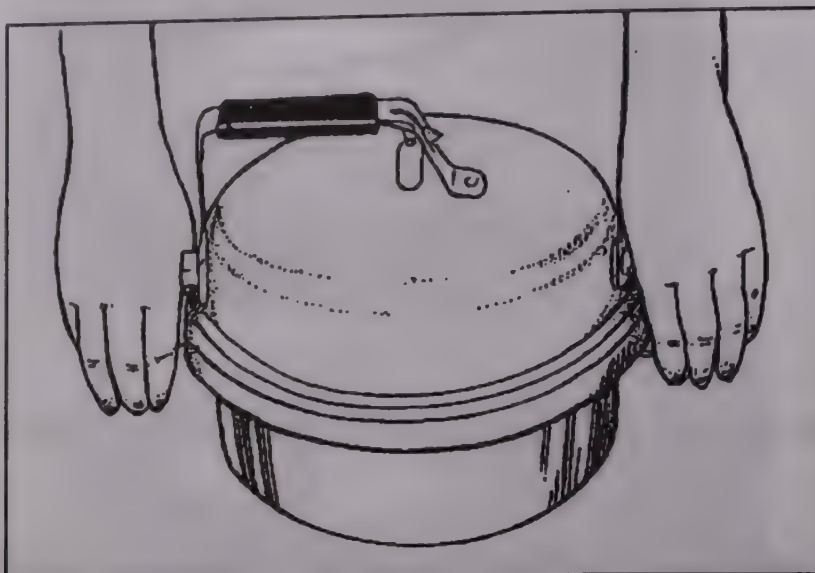
- **Put the sterilizer lid on the sterilizer base:** The V mark on the lid should line up with the handle on the base.

Figure 4-Y: putting the lid on the sterilizer base



-
- **Secure the lid to the base:** Press down on the handles of the lid and turn it clockwise until it will not turn any more. The handles of the lid should now be on top of the handles of the base.

Figure 4-Z: Cover in place



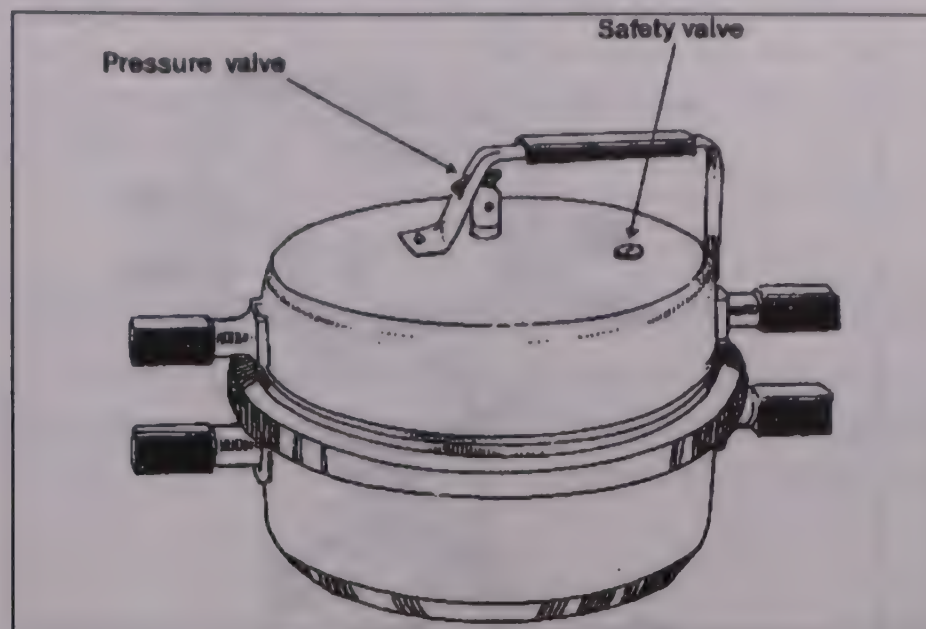
- **Check the valves on the sterilizer lid:** There are two valves on the sterilizer lid: the safety valve and the pressure valve. The **safety valve** is a small black circle of rubber with a metal pin in the middle. This valve opens if the water in the sterilizer boils away.

Make sure that the metal pin in the safety valve is down. The **pressure valve** controls the steam in the sterilizer. Make sure that the lever of the pressure valve is down.

Figure 4-AA: Sterilizer with both valves up



Figure 4-BB: Sterilizer with both valves down and ready for sterilization



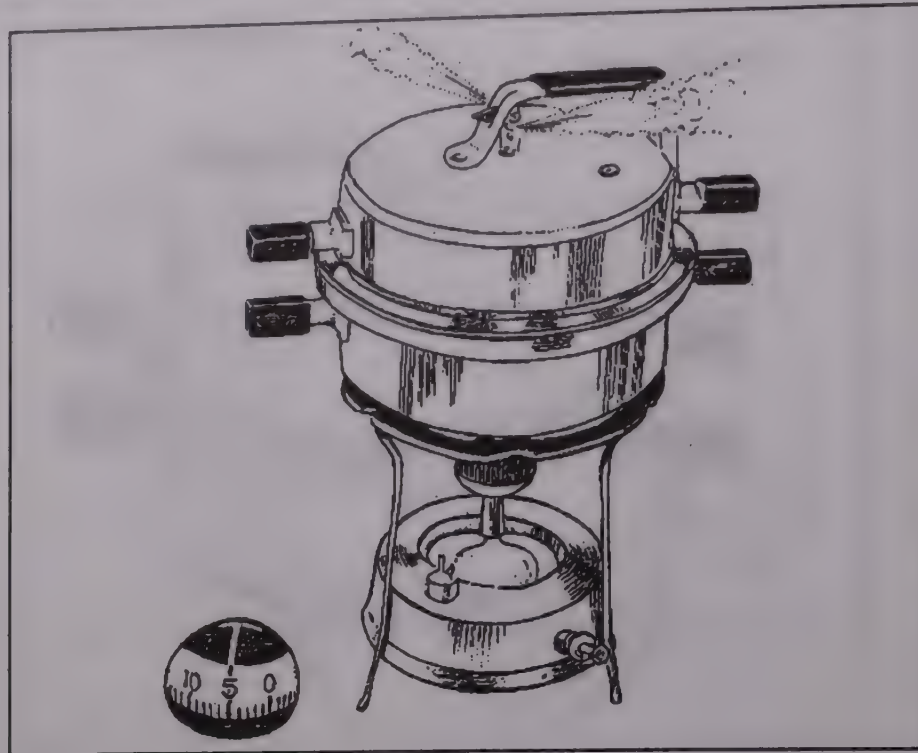
Sterilize

The most efficient way to sterilize reusable injection equipment is to steam it at a temperature between 121°C and 126°C for 20 minutes, in accordance with the manufacturer's instructions. The combination of time, steam and temperature kills tetanus spores, bacteria that cause abscesses, and viruses such as hepatitis B virus and human immunodeficiency virus (HIV). A TST indicator must be included in each sterilization cycle. It should be inspected at the time of use and attached to the immunization report.

Although boiling achieves high-level disinfection it does not sterilize and therefore is not recommended.

- **Light the stove and put the sterilizer on it:** Make sure that the stove is on a firm surface and out of children's reach. Light the stove and put the burner on high or full. Place the sterilizer on the stove.
- **When steam comes from the pressure valve, set the timer for 20 minutes:** Steam escapes from the pressure valve a few minutes after the burner has been turned to high. Set the timer for 20 minutes when this happens.

Figure 4-CC: Steam coming out, timer set for 20



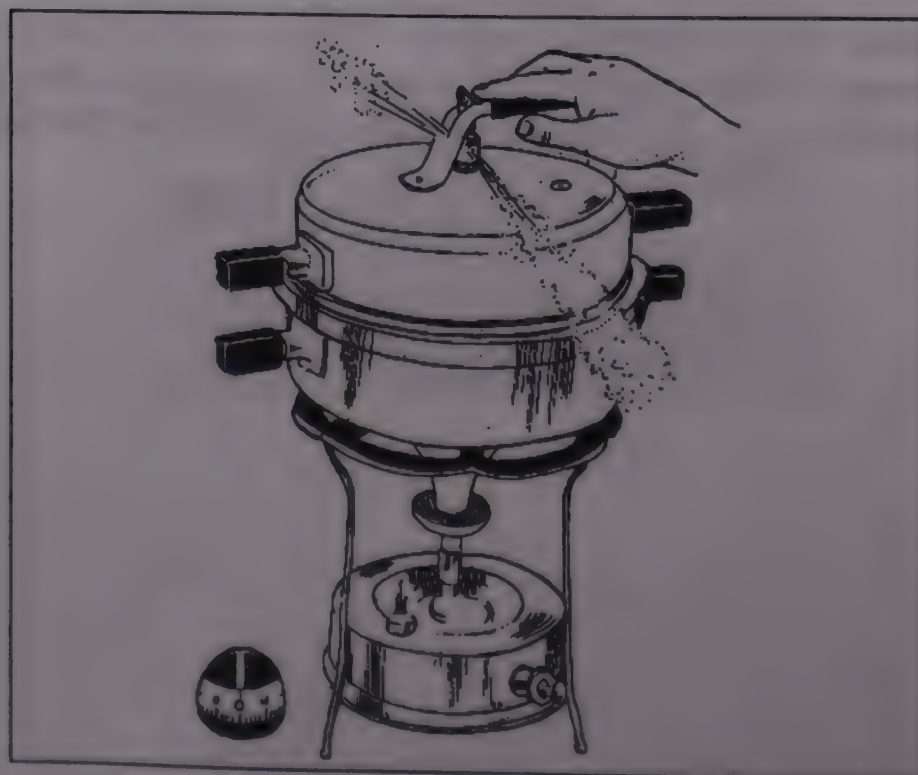
You may turn the burner down but not too low. You must be able to hear steam coming out of the pressure valve at all times.

- **When the timer rings, turn off the burner, open the pressure valve and remove the sterilizer from the stove:** After 20 minutes, when the timer rings, turn off the burner.

Open the pressure valve by lifting it up with forceps, a pencil, pen, spoon or other implement. Do NOT use your bare hands.

Steam escapes and makes a lot of noise. This is normal.

Figure 4-DD: Lifting the pressure valve



-
- Remove the sterilizer from the stove. Wait at least one hour for the equipment inside the sterilizer to cool before you take the lid off.

Use only cool syringes and needles to give injections. Warm ones can damage vaccine and cause pain to patients.

How to open a sterilizer and assemble syringes and needles is described in Module 7.

Sterilize equipment at the end of each immunization session.

2.4 Problems with steam sterilizers

- If steam is coming from under the sterilizer lid, check the position and quality of the rubber seal and adjust or replace it.
- If steam is coming from the safety valve, check the position of the safety valve and adjust or replace it.
- If the syringes have melted you may have used too little water or heated the sterilizer for too long, causing it to boil away. Use the correct amount of water and check your timing.

When you have problems with a sterilizer:

- turn off the heat;
- open the pressure valve;
- wait for the sterilizer to cool;
- identify the problem;
- correct the problem or use another sterilizer;
- inform your supervisor if necessary.

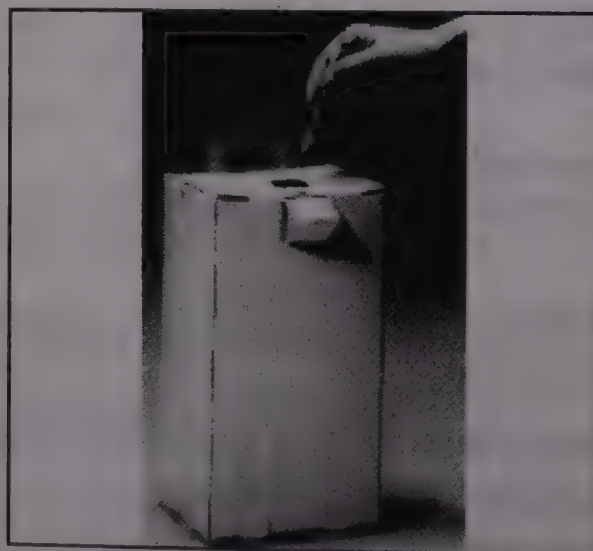
3. Disposing of syringes and needles

All syringes and needles must be safely disposed of when they can no longer be used. Single-use injection equipment is disposed of after one use, reusable injection equipment when it is worn out after many sterilizations or is no longer usable for other reasons.

3.1 Equipment

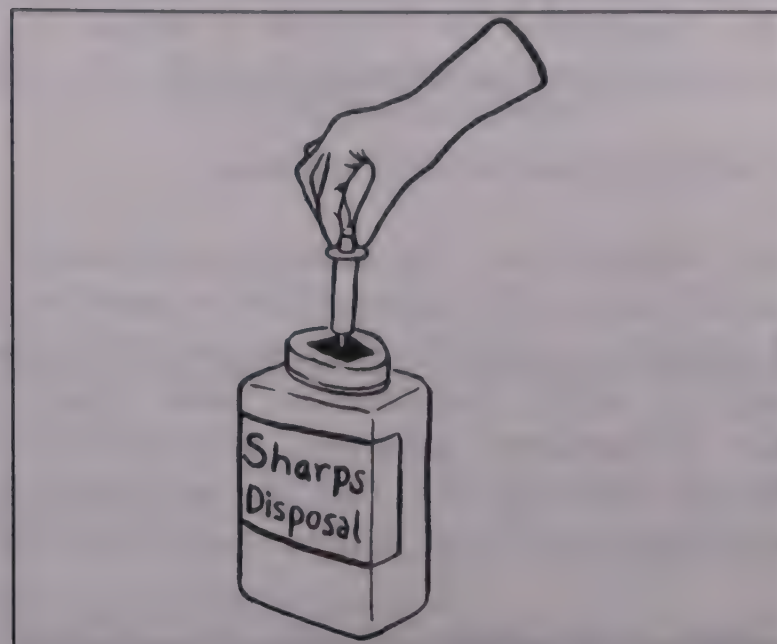
Before disposal, syringes and needles should be placed in a puncture-proof container. Special boxes for collection and destruction by burning may be purchased. These are waterproof and tamper-proof, and needles cannot pierce them.

Figure 4-EE: Puncture-proof box



Alternatively, you may use containers made of thick plastic, or metal cans, for collecting syringes and needles and transporting them to an incinerator or other site where they can be burned.

Figure 4-FF: Handmade disposal box



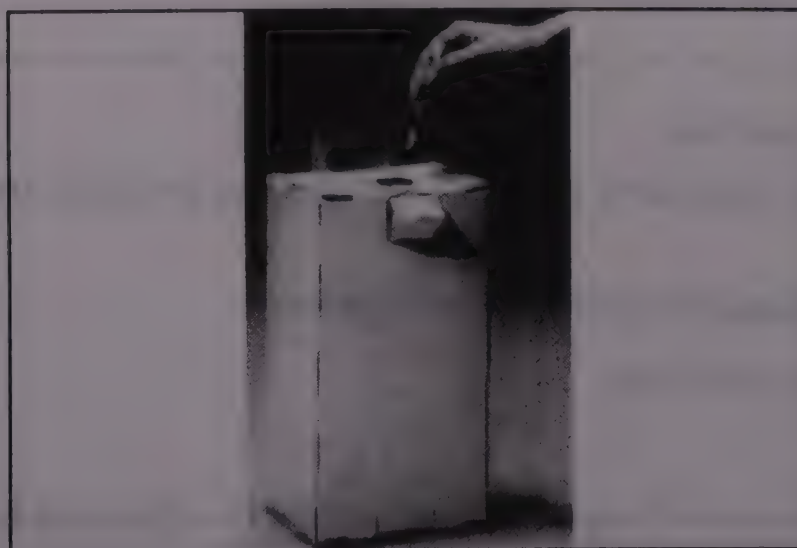
3.2 Procedures for disposing of injection equipment

All injection equipment is eventually disposed of. **Single-use** syringes and needles are used once and then destroyed. **Reusable** syringes and needles are destroyed when they become damaged.

Follow these steps to dispose of injection equipment safely:

- **Place syringes and needles in a disposal box**
 - **Single-use syringe and needle:** after a single use, place the used syringe and needle directly in a disposal box. To avoid needle-stick injuries, **do not attempt to recap the needle or to separate the syringe and needle.**

Figure 4-GG: Placing syringe and needle in box



- **Reusable syringe and needle:** if the scale on a syringe cannot be read or the plunger does not fit properly in the barrel, place it in a disposal box.

When a needle becomes blocked or barbed, place it in a disposal box. Contaminated sharps should not be transferred from container to container. If containers are transported in a vehicle it should be protected against contamination or disinfected before being used for other purposes.

- **When the box is full, dispose of it by burning**

A manufactured disposal box can hold approximately 100 syringes and needles. When full it should be destroyed by incineration as close as possible to the point of use and as soon after the immunization session as is practical. The compound in which incineration takes place must be secure. Autocombustion incinerators, achieving temperatures above 800°C, are preferred, although burning can also be performed in other types of incinerator or, for instance, in a pit, drum or constructed hearth.

Some manufactured boxes come with their own fuel source. Approximately four minutes after you have lighted the box the syringes and needles inside start to burn. Depending on the type of syringe it takes at least an hour for them to be completely destroyed.

Reusable needles may not be completely destroyed by burning, but they cannot be reused and will pose no risk of transmission of blood-borne infections after burning. Care must still be taken to prevent needle-stick injuries by burying the remains, as described below.

In some countries, used needles and syringes are collected from health centres by the district supervisor. The supervisor is then responsible for disposing of them safely.

- **Bury the remaining debris**

The remains of the needles and disposal box should be buried after burning. Bury them deeply in a pit latrine, controlled landfill, or a similar location where people do not have access to them.

Remember - Needles!

- **After using Treat used syringes and needles properly after every injection.**

Remember - Reusable syringes and needles:

- **Flush, soak and clean.**
- **Sterilize.**
- **When they can no longer be used, collect in a disposal box, burn and bury.**
- **Disposable syringes and once, collect in a disposal box, burn and bury.**

4. Preventing injuries and infections

You can reduce the risk of injuries and infections when handling injection equipment as follows.

- 1) Take care to prevent injuries when:
 - using needles to give immunizations;
 - handling needles after giving immunizations;
 - cleaning needles and loading the sterilizer;
 - disposing of used needles.
- 2) Do not recap used needles; do not remove used needles from syringes by hand.
- 3) Place used syringes and needles in puncture-proof containers for disposal. Keep a container as close as possible to the place where you give injections.
- 4) Immediately and thoroughly wash hands and other skin surfaces that have been contaminated with blood or other body fluids.

5. Supervision and evaluation

Systematic supervision and periodic evaluation of injection practices are vital to ensure safety. Supervisory visits should be made to each health centre at least twice a year, when a checklist should be used which includes a review of injection safety. An assessment of safe injection practices, injection equipment and the equipment supply system should be included in every EPI programme review and other evaluation activities. All injection-related adverse events should be routinely monitored and investigated with a view to improving the quality and safety of injections and assisting supervisory procedures.

6. Budgeting and supply

An uninterrupted supply of injection equipment is essential for the safety of immunizations.

A reserve stock of disposable injection equipment amounting to at least 10% of the quantity used in each supply period should be kept at central and intermediate stores. At peripheral stores the reserve stock should be sufficient for at least one month of immunization activities.

A stock of reusable syringes and needles should be maintained which equals 10% more than the largest number of injections given in a single session, and there should be sufficient fuel for sterilization and adequate spare parts for the maintenance of steam sterilizers.

Puncture-resistant containers should be provided in sufficient quantities to all health units for the collection and incineration of contaminated syringes and needles.

A distribution system should be established for all injection equipment which is the same as that for vaccines, involving:

- 1) a timetable of regular supply dates;
- 2) an estimate of routine needs based on rates of use;
- 3) planning of needs for special immunization activities;
- 4) a record of current stock levels.

An adequate budget should be established one year in advance for the supply of sufficient injection, sterilization and disposal equipment to cover routine immunization, special immunization activities and, if necessary, the replenishment of reserve stocks.

Immunization in practice

Module 5:

Organising immunization sessions



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva
1998*

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About this module

Although the activities required to organize immunization sessions are similar whether they take place in fixed facilities, outreach sites, or people's homes, there are some differences. This module describes how you prepare for sessions in all locations.

1. Preparing for immunization sessions in a fixed health facility

Immunization sessions must be arranged so that clients will attend the first time and return for subsequent doses. The preparations include:

- scheduling days and times for sessions;
- making sure that vaccines, supplies and equipment are available;
- arranging space for the convenience and comfort of health workers and clients.

1.1 Scheduling

Immunization services should be scheduled so that people can use them. If people are not coming to sessions or if too many people are attending you may need to change the days or times when the sessions are held.

Calculate the number of sessions per week or month you need, as described in the box following.

How often should you hold sessions?

- 1) Calculate the *annual target population*. For children this is the number aged under 1 year. If you do not know the size of the population, assume it to be 3% of the total population.

Example: if an area has a total population of 4800, multiply 4800 by 3% to obtain the annual target population (144 children).

- 2) Calculate the *monthly target population* by dividing the annual target population by 12.

Example: divide 144 by 12 to obtain the monthly target population (12 children).

- 3) Calculate the *average number of contacts per month*. Each time a child attends for immunization is called a contact. Three to five contacts are required for a child to be fully immunized.

To calculate the average number of contacts per month, multiply the monthly target population by 4.

Example: multiply 12 by 4 to obtain the average number of contacts per month (48 contacts).

- 4) Calculate the required *maximum number of sessions per month* by dividing the average number of contacts per month by the number of children that can be served by the health centre staff in a session. Depending on the number of staff and the availability of vaccines, supplies and equipment, this could be 10, 15, 20 or more.

Example: divide 48 by 10 to obtain the maximum number of sessions per month (4 or 5 sessions per month, or 1 session per week).

The same process can be used to calculate the number of sessions you need to immunize women with tetanus toxoid.

- After you have calculated the number of sessions per week or month, discuss with clients and other community members which days and times would be most convenient for them.

Keep in mind that:

- employed parents may be able to bring their children to the health centre only in the early morning or late afternoon;
- a market day may be a convenient time for shoppers to visit the health centre but this may not be true for vendors.
 - Make sure that health centre staff will be available to give immunizations on the proposed days and times and that you will have the vaccines and other supplies that you need on those days.
 - Tell everyone in the community about the days and times when immunizations will be given.

If you give immunizations on demand you may find that you run out of vaccines before the end of the month. This happens when you open a vial for one immunization and throw the unused vaccine away at the end of the day. By scheduling sessions you can estimate your vaccine needs more accurately.

However, you should not deny services to people who cannot come for immunizations on the scheduled days and times.

1.2 Supplies and equipment needed

Generally, you need the same supplies and equipment for fixed, outreach and mobile sessions. For fixed sessions you need the following supplies and equipment :

Vaccines

Take from the refrigerator the number of vaccine vials you think you will need for the entire session. You thus open the refrigerator door only twice, once at the beginning of the session and once at the end (to return unused vials).

Use the table below to estimate how many 10- or 20-dose vials you will need for a session. The number depends on the size of the target population and the number of sessions you have per month or week (see above).

It is a good idea to keep extra vials of diluent in reserve.

Number of clients	Number of vials needed
Less than 10	1 vial of each vaccine and diluent.
From 10 to 30	2 or 3 vials of each vaccine and diluent, depending on the number of doses in each vial.
More than 30	3 or more vials of each vaccine and diluent, depending on the number of doses in each vial. Take more from the refrigerator when needed.

Select and use vaccines in the following order:

- First :** Vials of OPV, DPT, TT and hepatitis B vaccine that have been opened for use in a previous fixed session.
- Second :** Unopened vials that have been out of the refrigerator for more than three hours.
- Third :** The oldest vaccines whose expiry date has not passed. You must discard vials whose expiry date has passed.

Injection equipment (see Module 4)

- **Syringes and needles:** you must use one sterile syringe and one sterile needle for each injection.
- **Reusable equipment:** you should have enough reusable syringes and needles available so that you do not need to sterilize during the session.
- **Single-use equipment:** you must have at least one single-use syringe and needle for each client expected.
 - Forceps.
 - Cotton swabs.
 - Metal file to open ampoules.
 - Vaccine carrier to hold vaccine and diluent vials during the session and keep them cold.
 - Ice packs for the vaccine carrier.

Use the table below to estimate how many syringes and needles you will need for a session:

Number of syringes and needles needed

	Number of clients expected			
	Fewer than 10	From 10 to 20	From 20 to 30	From 30 to 40
0.1 ml syringes BCG	5	10	10	10
10 mm, 26 gauge needles BCG	5	10	10	10
1.0 ml syringes DPT, measles, hepatitis B;	15	30	30	40
tetanus toxoid	5	10	12	15
32 mm, 22 gauge needles DPT, measles, hepatitis B	15	30	30	40
tetanus toxoid	5	10	12	15
5.0 ml syringes reconstitution	3	3	3	3
76 mm, 18 gauge needles reconstitution	3	3	3	3

Ice packs must be frozen in a refrigerator or ice pack freezer before you put them in the vaccine carrier. Ice packs will not freeze in a vaccine carrier.

See Module 3 for more information about vaccine carriers and ice packs.

Sterilization equipment (see Module 4)

- Plastic bowl for soaking and cleaning syringes and needles.
- Steam sterilizer.
- Stove and fuel.
- Timer.

Record-keeping materials

- Immunization cards for children and women.
- Immunization tally sheets.
- Patient register.
- Paper, pencils, pens.

Cleaning equipment

- Hand-washing items: soap in a soap dish, water, towel.
- Container for rubbish.
- Disposal boxes for syringes and needles that can no longer be used.

1.3 Arranging health centre space for immunizations

The arrangement of the space in your health centre will affect how you do your work and how quickly clients finish the immunization process. The space that you set up for immunizations should be:

- in a clean area not directly exposed to sunlight, rain or dust;
- convenient for the health worker who is preparing vaccines and immunizing;
- easily accessible to clients but arranged so that they are not crowding around the immunization station;
- quiet enough for the health worker to be able to explain what he or she is doing and give advice.

The health centre should have:

- space where clients can sit before being immunized;
- space and equipment for screening, registration, immunizing and recording;
- a table for vaccines and injection equipment;
- a chair on which a parent can sit while holding a child for immunization;
- a chair for the health worker.

If you provide other services during immunization sessions you need space and equipment for them as well. Set up a separate station for each of these services, which may include:

- weighing babies and charting their growth;
- treatment;
- antenatal care;
- health education.

1.4 Arranging equipment at the immunization station

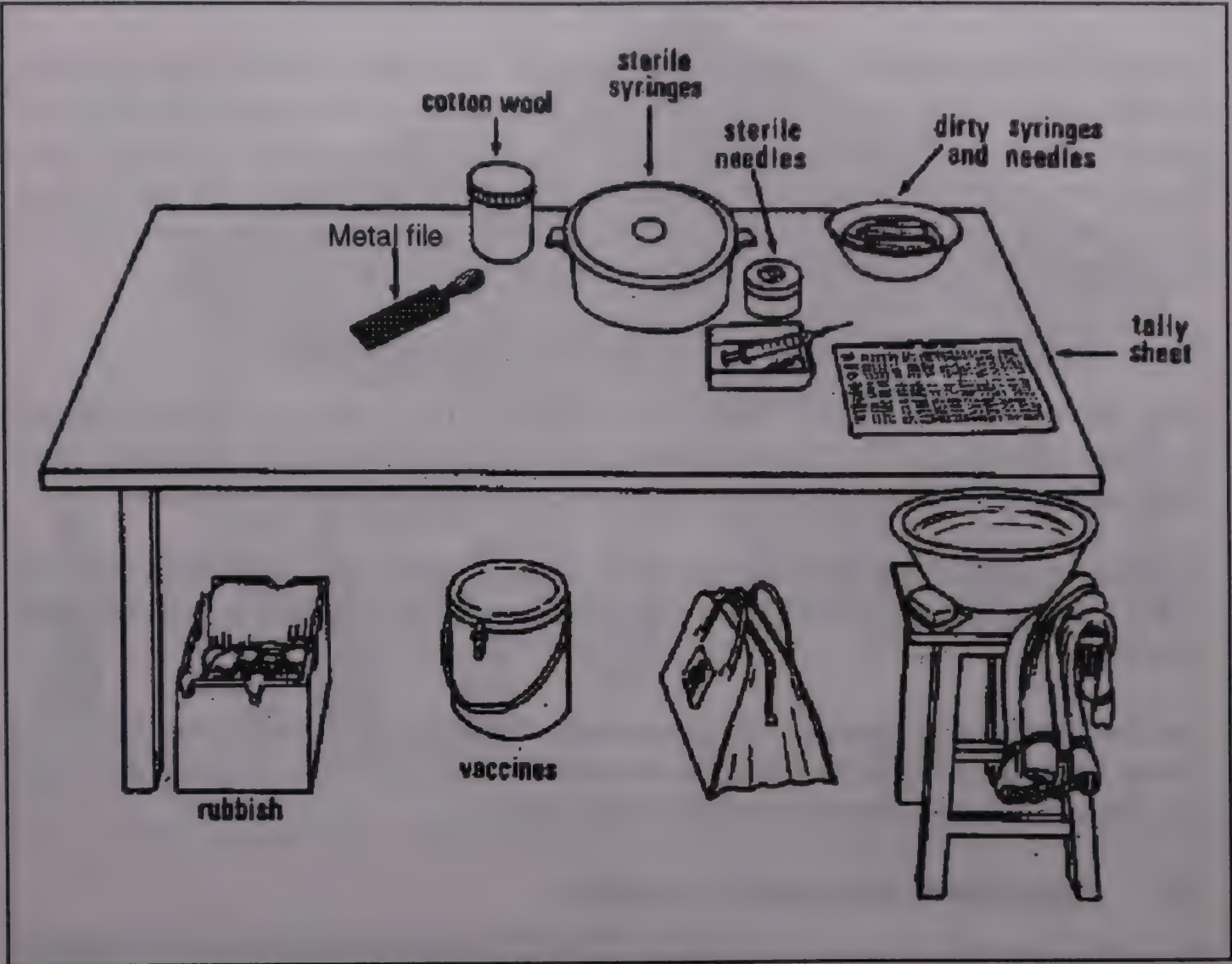
You need a table in a cool place to hold the equipment you use while giving immunizations. On the table you should put:

- a vaccine carrier in which to place vaccines and keep them cold;
- a plastic basin for soaking used syringes and needles;
- a disposal box for used single-use syringes and needles;
- a tally sheet and pencils;
- cotton swabs.

Near the table you should have a rubbish box, a bowl, soap in a soap dish, and a hand towel.

If you are registering patients at the same station you need a patient register there.

Figure 5-A: Equipment on table at immunization station



2. Organizing outreach immunization sessions

Outreach immunization sessions are held in a location other than a health facility, from which health workers can go out and return the same day. They are held periodically, at intervals of one, two or three months, or even twice a year. Successive outreach sessions in a community should be held in the same place (for example, the school), on the same day of the week and at the same time, to maximize the likelihood that people will remember to attend.

2.1 Scheduling days and times for outreach sessions

Use the process described above for deciding how often to hold outreach sessions (paragraph 1.1). You need to know the size of the target population and the number of children and women that you can immunize in one session.

Schedule outreach sessions at least one month apart: the multidose vaccines (DPT, OPV and tetanus toxoid) require an interval of at least a month between doses.

For the best results, consult with community leaders and clients about dates and times. They can help to mobilize the community on scheduled outreach days and can liaise with other members of the community.

2.2 Equipment and supplies needed

In addition to the equipment needed for fixed immunization sessions listed in paragraph 1.2 you need the following for outreach sessions:

- If you are supplied with reusable syringes and needles and do not have enough to use one sterile syringe and one sterile needle for each injection, take a steam sterilizer, stove, fuel, matches and a timer.

See Module 4 for more information about cleaning and sterilizing.

In most areas, vaccines stay below +8° C in a vaccine carrier for one day if you keep heat out of it. In order to achieve this:

- keep the carrier in the shade;
- keep the lid on the carrier in transit;
- keep opened vials on the foam pad of the carrier during sessions.

2.3 Setting up an outreach site

The place where you give immunizations during an outreach visit may be in a building or in the open air. If in a building it should be well lighted and well ventilated. If in the open air and in a hot climate it should be in the shade.

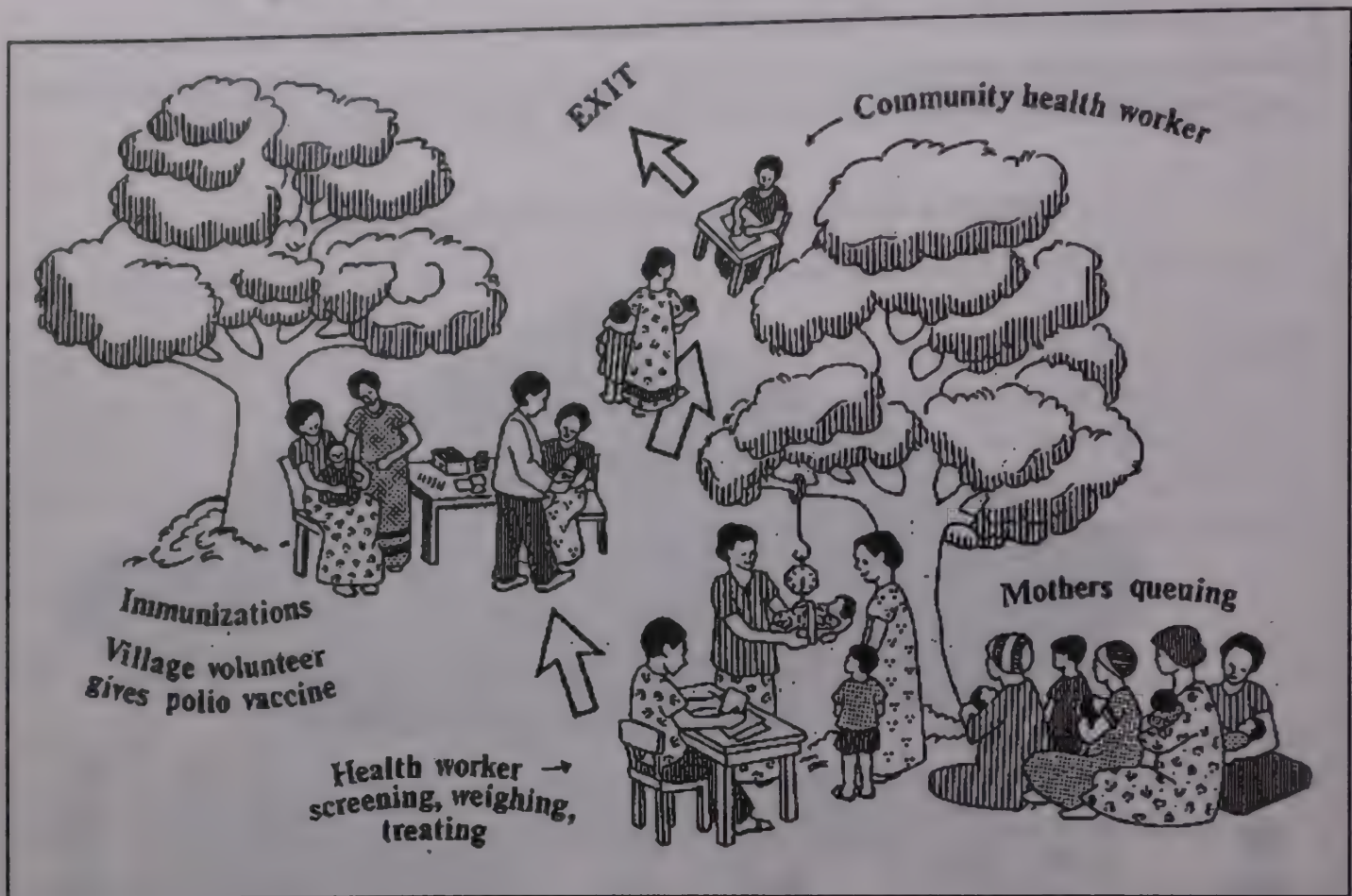
Figure 5-B: Immunization site in the open air



In arranging the immunization site, make sure that:

- the waiting area is clean, comfortable, and, in a hot climate, out of the sun;
- people are effectively guided to the entrance, the stations and the exit by means of signs or the arrangement of chairs, tables, ropes or other items;
- the number of people at the immunization and other stations are limited, so there is no crowding;
- if it is necessary to sterilize injection equipment during the session you do so in a safe place, away from children;
- everything you need is within reach on or near your immunization table.

Figure 5-C: Immunization session in the open air



Members of the community can supply you with tables, chairs and other furniture and can help you to set up the outreach site.

You may provide services additional to immunizations on an outreach visit, including prevention, treatment and health promotion. Make sure that the site is set up to accommodate these services.

3. Organizing mobile sessions

Mobile sessions are conducted by teams that travel to places distant from any health facility. They usually stay out at least one night. The teams may be workers from the nearest health centre or they may consist of district or national staff.

Unlike outreach sessions, which are scheduled periodically, mobile sessions are scheduled when needed. Teams often go to homes, fields, workplaces and schools, wherever the target population exists.

Immunization in practice

Module 6:

During a session:

Registering and assessing clients



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva
1998*

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About this module

Health workers record immunization activities in a patient register and on immunization cards. They also decide whether or not to give an immunization to a particular child or woman and what to give. The present module describes how to perform these activities.

1. Completing the patient register

Most health centres keep a patient register in which information is written about every person who comes to the facility for any service. This provides a record of what the health centre does and helps health workers to keep track of the immunizations and other services they give to each person. Patient registers are also useful in identifying missed opportunities (Module 11), case-based disease surveillance (Module 12) and other research.

Figure 6-A: Sample patient register page

Month: January Year: 1990

Date of visit	Name and address	Age	Reason for visit	Repeat visit?	Services provided	Was patient immunized with all required doses? ^a (e.g., all 3 doses of DPT or OPV)
2	Maria Falcon, Tomara	4 months	immunization		DPT2 / OPV2	
2	Malikul Somtha, Tomara	10 months	measles		paracetamol & talcum powder	no
2	Alaba Idris, Tomara	2 years	dysentery		ORS and antibiotics	
2	Halida AKrong, Bakul	7 months	malaria	✓	chloroquine & DPT3 / OPV3	
2	Teresa Garcia, Bakul	6 months	polio		referred to district hospital	no
2	Juan Moreno, Tomara	17 years	gonorrhea	✓	antibiotics	
2	Kim Lwin, Efeson	3 years	respiratory illness		antibiotics	
2	Anna Eapen, Tomara	21 years	antenatal	✓	routine antenatal and TT2	
2	Jai Narain, Efeson	4 years	chronic diarrhoea	✓	antibiotics & ORS	
2	Tomas Gonzalez, Efeson	18 months	malaria		chloroquine & measles immun.	
2	Obanu Lasiso, Bakul	11 months	measles and diarrhoea		Vitamin A, ORS, paracetamol	no
2	Oneta Samai, Efeson	25 years	antenatal		routine antenatal & TT3	
2	Carlos Gomez, Tomara	1 week	immunization		BCG & OPV0	
2	Seyed Alam, Tomara	6 months	immunization		DPT3 / OPV3	


A patient register should include at least the following information:

- date, month and year of visit;
- name of client;
- client's address and, if applicable, telephone number;
- client's age or birth date;
- client's sex;
- services provided, e.g., OPV1, DPT1.

When a client arrives at a health centre or outreach site the first thing you should do is register her or him. Fill in all the blanks except that for services provided, this one being completed after the services have been given.

If a client does not have an immunization card you should provide one and enter on it the person's name, address and birth date. More information is added when the client is screened. Do not write down the date of an immunization until it has been given. (See sections 2 and 3 below.)

Figure 6-B: Child's immunization card



CERTIFICATE OF IMMUNIZATION

World Health Organization

Please write with a ballpoint pen

(Name, ID Number, Address)

Sex:

Date of birth:

Vaccine type

Dose 1

Dose 2

Dose 3

Dose 4

Dose 5

DPT

DT/Td


Tetanus toxoid

Vaccine type	Dose 1	Dose 2	Dose 3	Dose 4	Dose 5

This card was provided with the assistance of:

Australian International Development Assistance Bureau

Figure 6-C: Woman's immunization card



CERTIFICATE OF IMMUNIZATION

World Health Organization

(Name, ID Number, Address)

Dose

Date

TETANUS TOXOID

Given by

Dose

Date

Given by

1

4

2

5

3

6

FBI In:

Date of vaccination in top of box.

Name of vaccinator or health unit in bottom of box.

Vaccine	Dose 1	Dose 2	Dose 3	Dose 4	Dose 5

This card was provided with the assistance of:

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2

Immunization in Practice: Module 6

2. Assessing the client

The purpose of assessing a client is to find out what immunizations he or she is eligible for and whether there is any reason not to give them. You must know the standard immunization schedules for children and women, how to recognize contraindications, and other information on which to base your decisions.

If the client has come to the health centre for reasons other than immunization, such as treatment or antenatal care, find out about these too as part of the screening process. If a client is ill, give her or him help as soon as possible but make sure that you immunize the client before or after treatment.

If a child with measles or another communicable disease comes to the health centre, immediately isolate her or him from others.

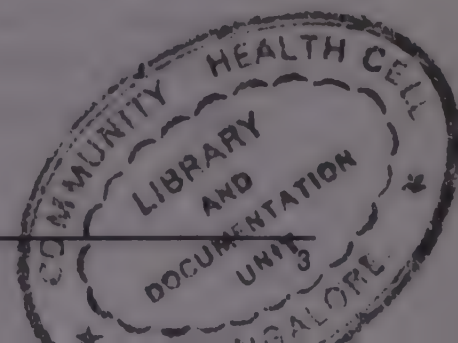
Answer the following questions before you immunize:

2.1 Is this the right time to give a child an immunization?

Look at the child's immunization card. If he or she does not have one, ask the parent how old the child is and what immunizations he or she has had. Check the patient register, where you may find records of a child's earlier immunizations.

Below is the schedule recommended by WHO for immunizing children.

Age	Vaccines	Hepatitis B vaccine*	
		Scheme A**	Scheme B**
Birth	BCG, OPV0	HB1	
6 weeks	DPT1, OPV1	HB2	HB1
10 weeks	DPT2, OPV2		HB2
14 weeks	DPT3, OPV3	HB3	HB3
9 months	Measles Yellow fever		
* Scheme A is recommended in countries where newborns are at risk of being exposed to hepatitis B through their mothers.			
* Scheme B is recommended where this risk does not exist.			



Does the child need another BCG injection?

If a child received a BCG injection during the last visit, look at the child's upper right arm.

If there is a swelling, an ulcer or a scar, tick the child's immunization card next to the place where the BCG immunization was recorded.

If there is no mark, BCG should be given again during the visit.

How many doses has the child already had?

A child usually receives:

- only one dose each of BCG vaccine, measles vaccine and yellow fever vaccine;
- four doses of OPV;
- three doses each of DPT vaccine and hepatitis B vaccine.

Has sufficient time elapsed since the last dose?

None of the multidose vaccines (OPV, DPT vaccine, hepatitis B vaccine) should be given less than four weeks apart. If the interval between doses is less than four weeks the child is not adequately immunized.

2.2 Is this the right time to give a woman an immunization?

Below is the schedule recommended by WHO for giving tetanus toxoid to women of childbearing age.

Dose	When to give	Period of protection
TT1	At first contact with woman of childbearing age; or as early as possible in pregnancy.	None.
TT2	At least 4 weeks after TT1.	3 years.
TT3	At least 6 months after TT2.	5 years.
TT4	At least 1 year after TT3.	10 years.
TT5	At least 1 year after TT4.	All childbearing years.

- Is the woman at the right age for tetanus toxoid? Your country has defined who is included in the childbearing age group. In some places, women aged 15-35 years are included; in some the age range is 14-44 years; and in others tetanus toxoid immunizations are given to girls in primary school.
- How many doses has she already received? Five doses of tetanus toxoid give protection for at least the childbearing years. In the future, as more women acquire immunization cards showing that they received DPT vaccine (which includes tetanus toxoid) or TT during childhood, fewer doses of tetanus toxoid may be needed in adulthood.

-
- How much time has passed since the last dose? See the schedule above for the time you should wait between doses.

2.3 Can I give different vaccines at the same time?

All the EPI vaccines are safe and effective when administered at the same time but they should be given in different parts of the body when this happens.

For example, a child aged 1 year who has never been immunized can receive BCG, OPV1, DPT1, hepatitis B, measles and yellow fever vaccines at one time.

Remember:

- Do not give more than one dose of the *same vaccine* at one time.
- Do not mix different vaccines in one syringe before injection. Use a different syringe and needle for each vaccine and for each injection.

2.4 Should I give a booster dose?

The answer to this question depends on the policy in your country. For example, if the policy is to give a DPT booster (DPT4) at 18 months of age you must give it. In general, WHO suggests that booster doses should not be given until immunization coverage is above 80%.

Note. In some countries, TT4 and TT5 are called booster 1 and booster 2 respectively and are not considered part of the primary schedule.

2.5 Should I immunize even though the child or woman has received one or more doses of the vaccine in a campaign or outbreak response?

Special immunization campaigns are sometimes conducted against polio, measles, diphtheria, neonatal tetanus and other diseases, in which all people in a certain age group are targeted for immunization, irrespective of their previous immunization history.

If children, previously immunized during a polio or measles campaign or an outbreak response, attend a health centre or outreach site for a routine polio or measles immunization, you should immunize them as if the campaign or response had not occurred.

However, tetanus toxoid received as part of a neonatal tetanus campaign should be counted as part of a woman's immunization schedule. Women should not be immunized again with the same dose of tetanus toxoid.

2.6 Is there a contraindication to immunization?

There are few contraindications to immunization. You should immunize every eligible child and woman, except in the following rare situations:

- Do not give the second or third dose of DPT vaccine to a child who has had a severe reaction to an earlier dose. Severe reactions include a convulsion or shock within three days after the injection.
- Do not give BCG or yellow fever vaccine to a child with the signs and symptoms of AIDS.
- If a parent strongly objects to an immunization for a sick child, do not give it.

Remember:

There are almost no contraindications to EPI vaccines. It is safe to immunize children and women even if they are ill.

You can immunize children and women affected by:

- minor illnesses, including colds, diarrhoea and fever;
- allergy, asthma;
- malnutrition.

You can immunize premature infants and breast-feeding children.

3. Completing clients' immunization cards and informing clients

When you assess clients (section 2 above) you use their immunization cards to find out what immunizations they have had and which ones they need.

When you finish the assessment, discuss with the parent (or the woman) what vaccines are required on the day of the assessment and when to return. Describe possible side-effects and explain what to do about them.

If another health worker is giving the immunizations, tick the appropriate boxes on the card to show the health worker which immunizations to give.

Do not write down the date of the immunization at this time. Only do so when the immunization has been given.

Give the card back to the parent and ask her or him to bring it to the immunization station.

After immunizing, write down the date for each vaccine and dose administered and give the card back to the parent. While thanking the parent for coming, remind her or him about:

- the date and time of the next immunization;
- where to attend for the next immunization;
- the number of immunization visits remaining;
- the side-effects that may occur;
- how to deal with these side-effects.

Note. Tally sheets provide another way of record-keeping, being used to count the number of immunizations given in a day (see Module 11).

Remember:

If assessment is not performed carefully you may miss an opportunity to immunize. Two of the commonest reasons for missing such an opportunity are:

- failure to give in one visit all the vaccines for which a child is eligible;
- failure to give a vaccine because of false contraindications to immunization.

Immunization in practice

Module 7:

During a session:
Preparing vaccines



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva
1998*

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About this module

This module describes how to prepare vaccines for an immunization session and how to reconstitute BCG, measles and yellow fever vaccines. Follow the instructions carefully to provide clients with safe and effective immunizations.

1. Washing hands

By washing your hands with soap you remove microorganisms from them and help to prevent contamination. However, even after thorough washing some microorganisms remain on your hands. You should therefore touch syringes and needles as little as possible.

Figure 7-A: Washing hands



Even after thorough washing, some micro-organisms remain on your hands.

2. Opening the sterilizer if you have reusable syringes and needles

(See Module 4 for instructions on sterilizing injection equipment.)

Do not open the sterilizer until you need a sterilized syringe and needle.

2.1 Take off the sterilizer lid

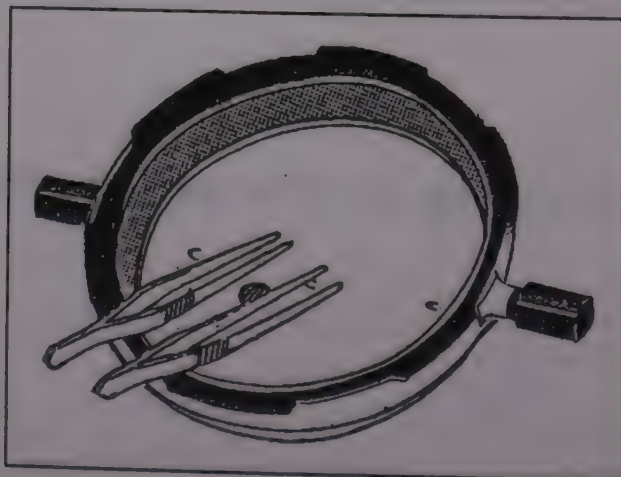
Wait at least an hour after taking the sterilizer off the burner for the equipment inside to cool. Then turn the sterilizer lid anticlockwise until it will not turn any more.

Lift off the lid and put it upside down on the table.

2.2 Move the forceps to the sterilizer lid

Move the forceps from the rack lid to the sterilizer lid. Do not touch the tips of the forceps with your hands. Do not let the tips touch anything except the inside of the sterilizer lid.

Figure 7-B: Forceps on sterilizer lid



3. Assembling a sterile syringe and needle

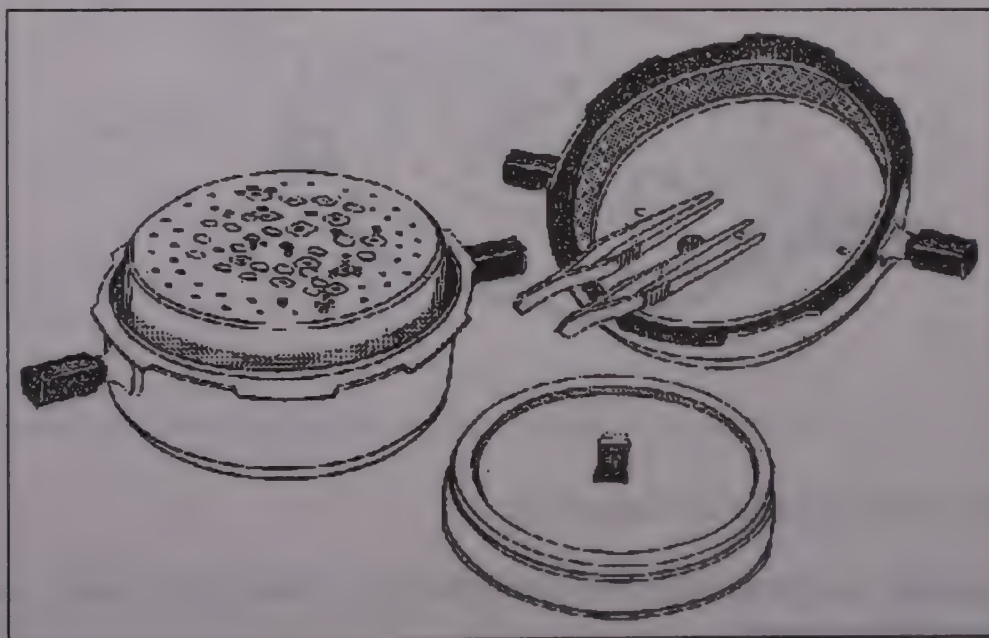
Assemble a syringe and needle only when someone is waiting to be immunized.

3.1 Remove the rack lid and put it on the table

Squeeze the clip on the handle of the rack lid and remove it carefully. Put it on the table with its top up as shown below.

The rack itself should remain in the base.

Figure 7-C: Base and cover and rack cover with forceps on base cover

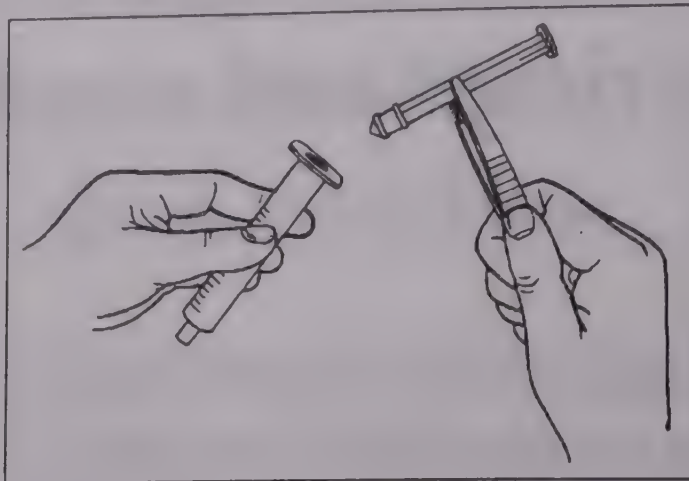


3.2 Fit together the parts of one syringe

Take the sterile forceps from the sterilizer lid and use them to pick up a plunger of the size you need from the rack. (See Module 4 for information about syringe and needle sizes.)

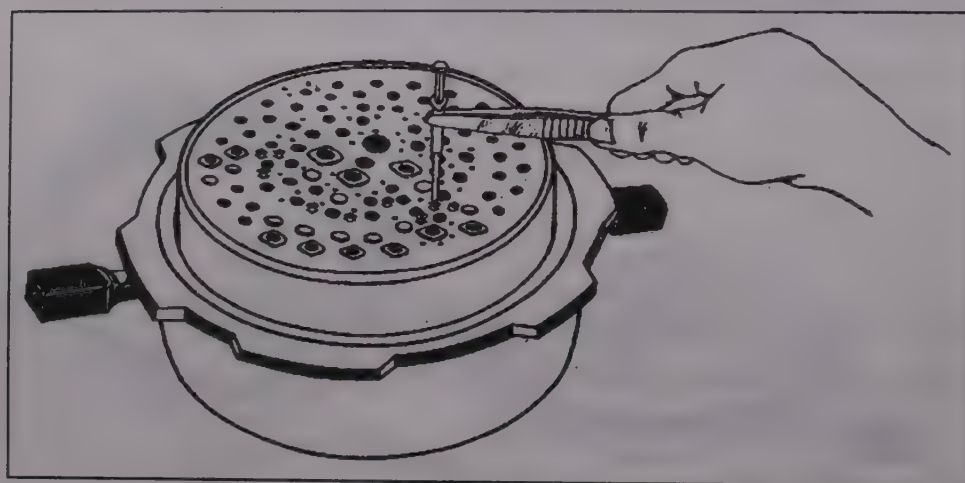
Using the forceps, fit the plunger into a barrel of the same size.

Figure 7-D: Putting a plunger into a barrel, using sterile forceps



Using the forceps, pick up the assembled plunger and barrel and fit a needle of the correct size.

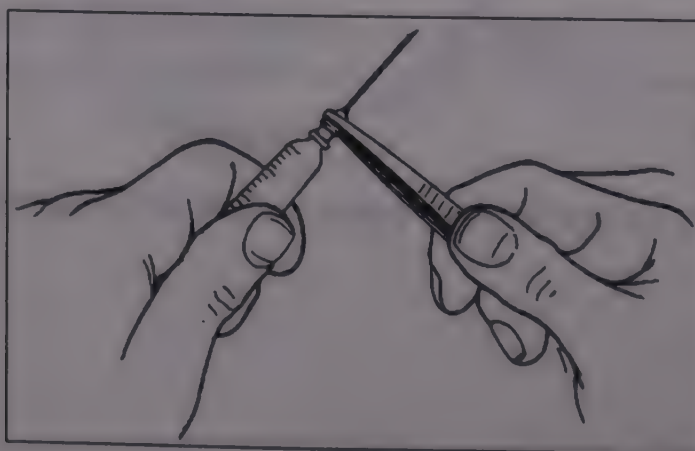
Figure 7-E: Assembling a syringe and needle



3.3 Twist the needle to secure it

Hold the needle adaptor with the forceps and rotate it to make sure that it fits securely into the syringe.

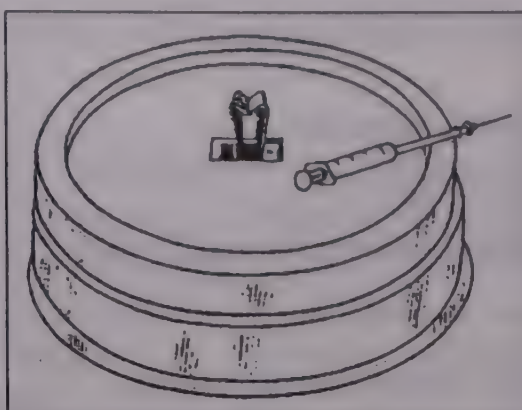
Figure 7-F: Twisting the needle to secure it



3.4 If you need to put the syringe and needle down, place them on the rack lid

Place the assembled needle and syringe on the rack lid if you need to put them down, and make sure that the needle does not touch the rack lid or anything else.

Figure 7-G: Syringe and needle on a rack lid



4. Checking the vaccine and diluent vial labels

Before you use any vaccine or diluent, check the labels.

- Is the label still attached to the vial?
- Is it the right vaccine or diluent?
- Has the vaccine or diluent passed its expiry date?

If the label has come off, throw the vial away.

If the vaccine inside has passed its expiry date, throw the vial away.

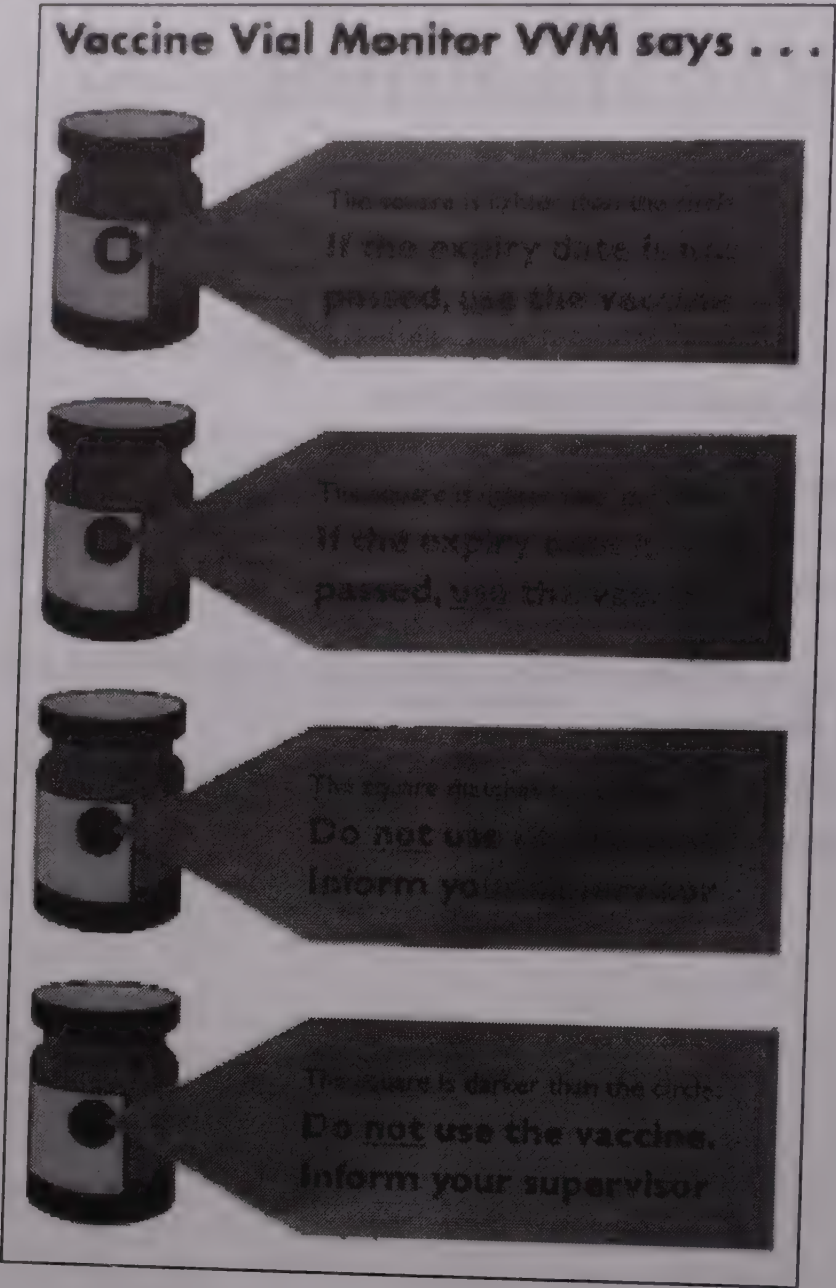
5. Checking the vaccine vial monitor

If a vaccine vial has a vaccine vial monitor (VVM) attached, check whether the vaccine has been exposed to excessive heat.

The VVM is printed on the vial label or cap. It looks like a square inside a circle. If it has changed colour the vaccine inside can no longer give protection against disease and you must discard the vaccine.

- If the inner square is lighter than the outer circle **and** the expiry date has not passed, **USE** the vaccine.
- If the inner square is the same colour as or darker than the outer circle, **DO NOT USE** the vaccine.

Figure 7H: Vaccine vial monitors - showing colour changes



6. Cleaning the skin before an injection

Use cotton wool and a small amount of spirit. If you do not have spirit, use soap and water, or water only. Do not use antiseptic.

7. Drawing vaccine from a vaccine vial

When you are ready to give an injection, follow the steps indicated below for drawing the vaccine from a vaccine vial into a syringe:

- 1) Assemble a sterile syringe and needle of the correct size (see section 3). Turn the needle adaptor with forceps to make sure that the needle is fixed firmly to the syringe.
- 2) Draw air into the syringe by pulling back on the plunger. You need the same amount of air in the syringe as the amount of fluid to be taken out of the vial.
- 3) Push the needle through the rubber stopper into the vaccine vial.
- 4) Inject the air into the vial by pushing in the plunger.
- 5) Draw the vaccine out of the vial by pulling back the plunger. The vaccine comes out easily because the air you have injected takes its place.
- 6) Point the needle upwards and press in the plunger to get rid of air bubbles and excess vaccine.

Read the scale on the barrel of the syringe to make sure that you have the correct amount of vaccine.

You are now ready to inject the vaccine (see Module 8 for instructions on administering each vaccine).

8. Reconstituting vaccines

BCG, measles and yellow fever vaccines must be reconstituted before they can be used. Reconstitution means mixing the dry powder form of a vaccine with a fluid called a diluent so that the vaccine can be injected.

Follow the steps indicated below to reconstitute vaccines.

Do not begin this process until clients have arrived and you are ready to immunize.

Reconstituted vaccine lasts only six hours.

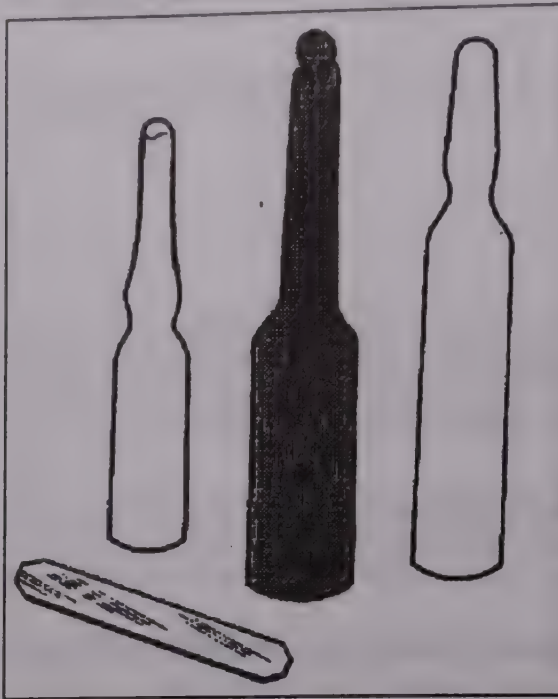
8.1 Wash your hands

Wash your hands with clean water and soap before reconstituting vaccines.

8.2 Open diluent ampoule

The diluent for reconstituting BCG, measles and yellow fever vaccines is usually held in **ampoules**, which are glass bottles that you open by breaking off their pointed glass tops.

Figure 7-I: Ampoules and metal file



Read the label on the ampoule to be sure that (1) it is the diluent the manufacturer sent with the vaccine you are reconstituting and (2) the expiry date has not passed. Inspect the ampoule for cracks.

Remember:

Use ONLY the diluent that the manufacturer sends with the vaccine.

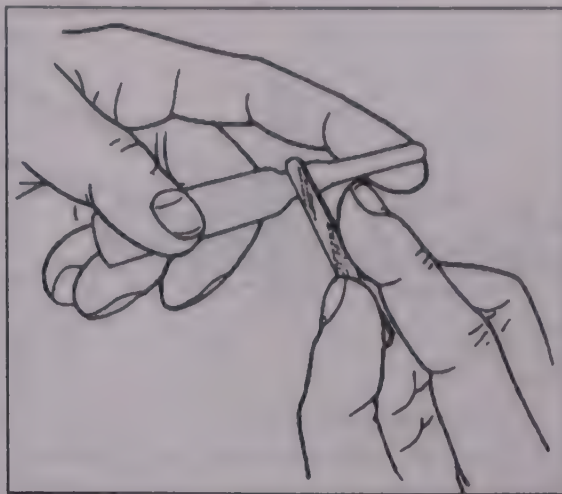
Use ONLY:

- BCG diluent with BCG vaccine;
- measles diluent with measles vaccine;
- yellow fever diluent with yellow fever vaccine.

Proceed as follows to open an ampoule.

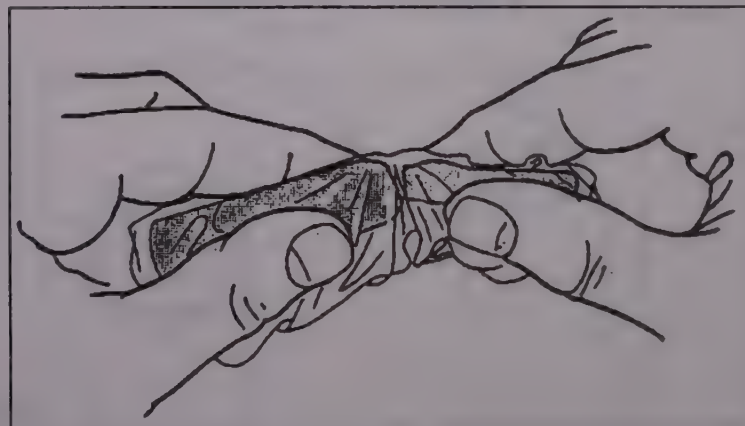
- 1) Hold it between your thumb and middle finger.
- 2) Use your index finger to support the top.
- 3) Take the metal file that is packed with the ampoules and scratch hard around the neck of the ampoule you wish to open.

Figure 7-J: "Scratching" the neck of the ampoule



- 4) Wipe the outside of the ampoule with cotton wool and clean water. This removes pieces of glass produced by filing and prevents them from getting into the vaccine.
- 5) Hold the ampoule in a piece of clean cloth and gently break off the top. It breaks where you made the scratch.

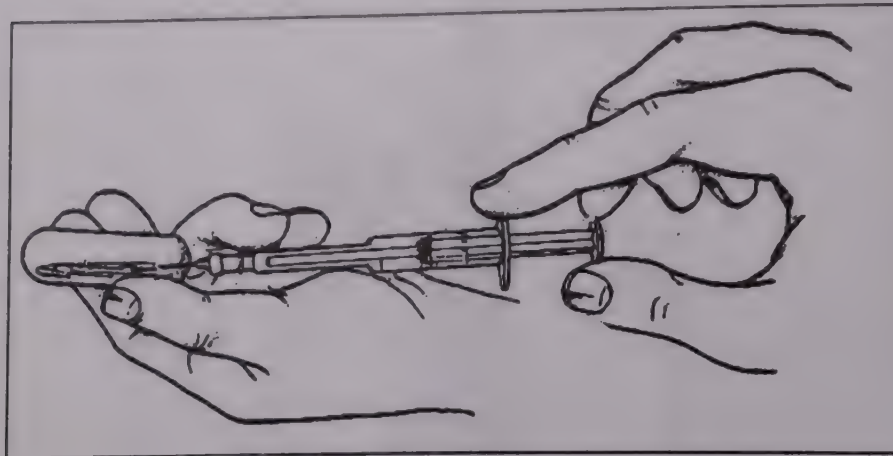
Figure 7-K: Breaking off the neck of an ampoule



8.3 Draw diluent into syringe

- 1) Choose a sterile mixing (5 ml) syringe and a sterile mixing (76 mm, 18 gauge) needle and mark the syringe "BCG", "measles" or "YF" so that you use it only for reconstituting one kind of vaccine.
- 2) Put the needle in the open top of the ampoule and pull back the plunger to draw all the diluent from the ampoule into the syringe.

Figure 7-L: Taking fluid from an ampoule

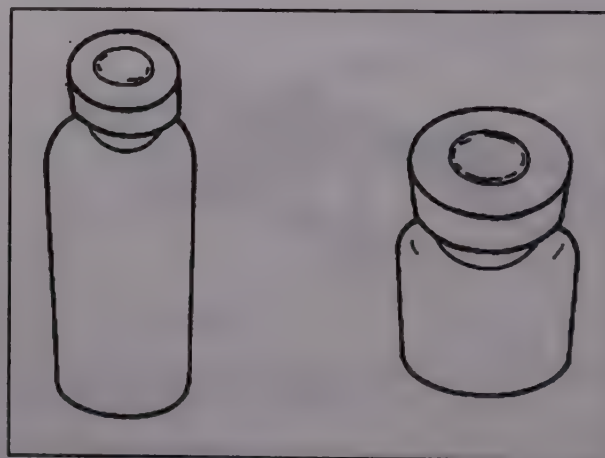


8.4 Open vaccine vial or ampoule

Most vaccines come in **vials**, except for BCG vaccine, which comes in ampoules.

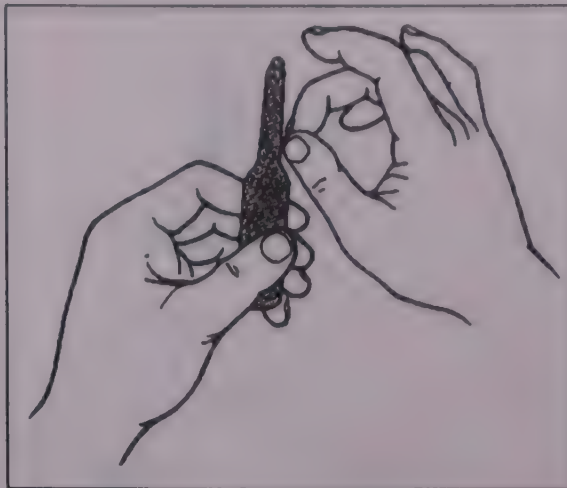
A **vial** is a glass bottle with a rubber stopper held in place by a metal cap. The centre of the metal cap is pre-cut so that it can easily be removed.

Figure 7-M: Vials



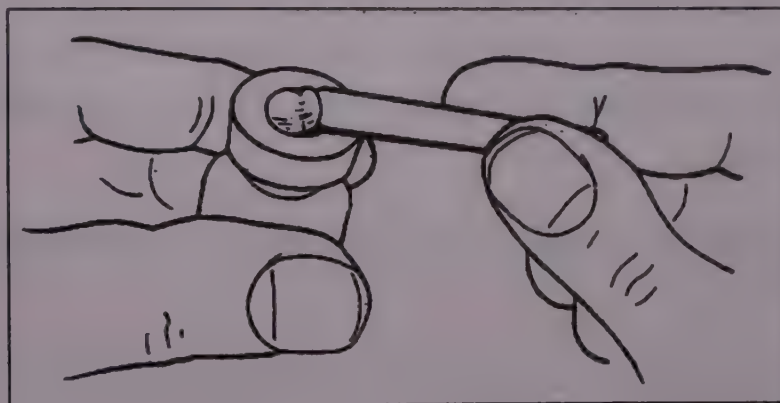
- 1) Before opening a vial, check the VVM. Read the expiry date on the label to make sure that you can still use the vaccine.
- 2) Flick the vial to make sure that all the vaccine powder is at the bottom.

Figure 7-N: Flicking a vaccine ampoule



- 3) Lift the centre of the metal cap and bend it back, using the same metal file as for opening ampoules.

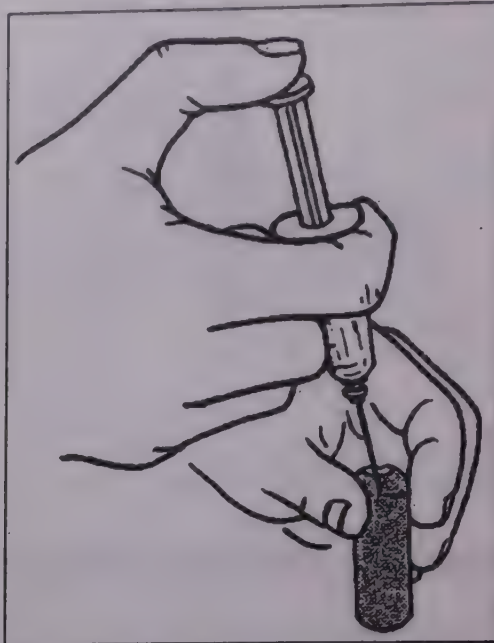
Figure 7-O: Lifting the metal cap



8.5 Reconstitute

- 1) Insert the mixing needle into the vaccine vial or ampoule.
- 2) Hold the plunger end of the mixing syringe between your index and middle fingers and push the plunger in with your thumb. This empties the diluent into the vaccine.

Figure 7-P: Emptying a syringe



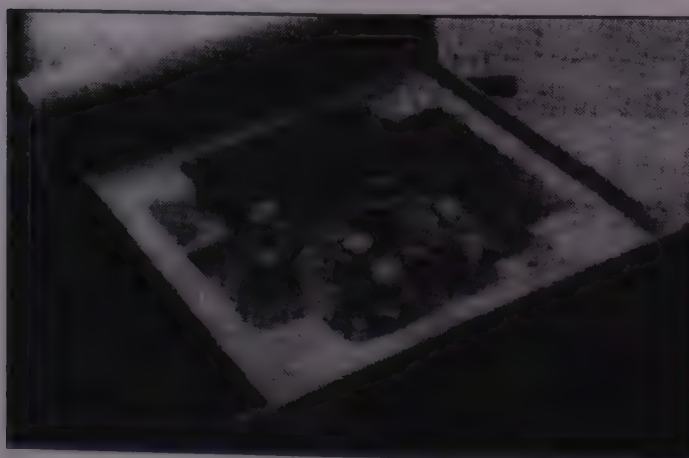
- 3) To mix the diluent and vaccine, draw them slowly up into the syringe and inject them slowly back into the ampoule. Repeat this several times.
- 4) If you think you may need to reconstitute more of the same kind of vaccine during the session.

You can put the mixing syringe and needle on the sterilizer rack lid for use later in the session.

- 5) Wrap the reconstituted vaccine in foil to protect it from dirt and sunlight. Keep it in the shade.

Put the vaccine on the foam pad of your vaccine carrier.

Figure 7-Q: Keeping vaccine cold on a foam pad



- 6) When you no longer need an empty diluent ampoule, dispose of it in a safety box.

Destroy all reconstituted vaccine after six hours.

Immunization in practice

Module 8:

During a session:
Giving immunizations



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva
1998*

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About this module

When giving immunizations during a session, every vaccine must be given in a certain place and in a certain way. This module provides instructions for positioning the client and administering EPI vaccines.

1. How to give a BCG immunization

BCG vaccine comes as a dry powder. Before you can use it you must reconstitute it with diluent (see Module 7).

Remember about BCG immunization: before you use any vaccine or diluent check:

- whether the label is still attached to the vial; if it is not, dispose of the vial;
- whether it is the right vaccine or diluent;
- whether the expiry date of the vaccine or diluent has passed; if it has, dispose of the vial;
- whether the vaccine vial monitor (if one is present on the vial) has changed colour; if it has, dispose of the vial.

1.1 Position the child

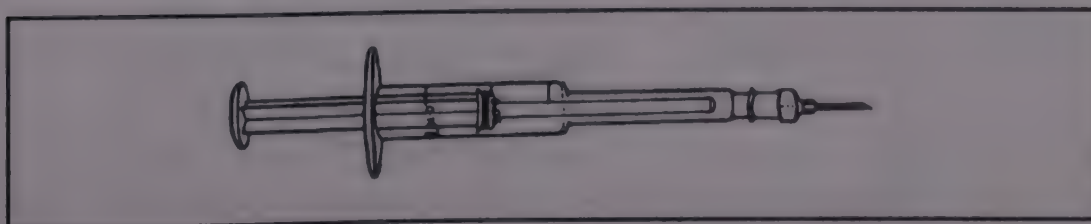
BCG vaccine is usually injected on the outer part of the left upper arm. Inject the vaccine in the same place for each child to make it easy to find the BCG scar subsequently.

Ask the parent to free the child's arm from its clothing, to seat the child on her or his lap, and to hold the child firmly.

1.2 Inject the BCG vaccine

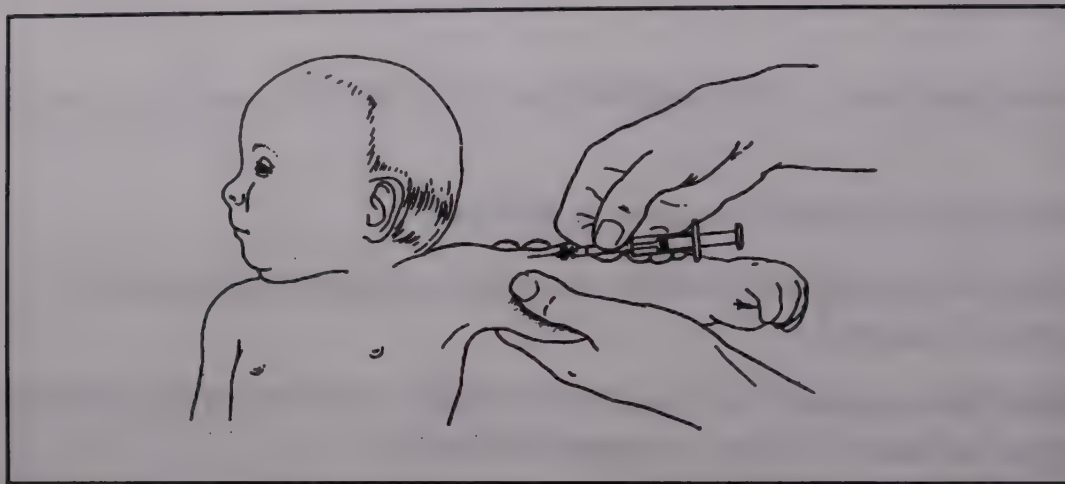
The dose of BCG vaccine is only 0.05 ml. To measure and inject such a small dose accurately you must use a special BCG syringe (0.1 ml), and a special BCG needle (10 mm, 26 gauge) (reusable).

Figure 8-A: BCG syringe and needle



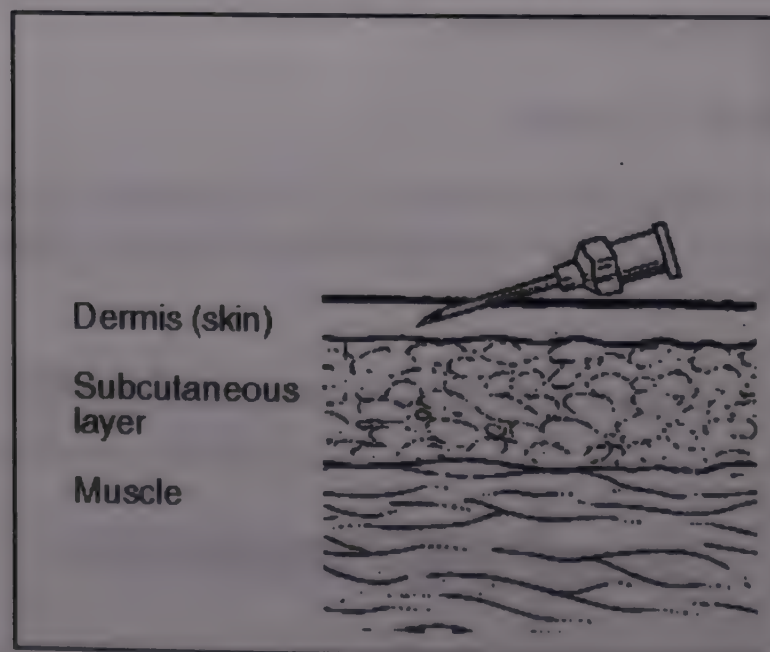
- 1) Load the syringe with BCG vaccine.
Do NOT shake the BCG vaccine ampoule. Shaking can damage the vaccine.
- 2) Hold the child's arm with your left hand so that:
 - your left hand is under the arm;
 - your thumb and fingers reach around the arm and stretch the skin tight.
- 3) Hold the syringe in your right hand, with the bevel of the needle facing up towards you.
- 4) Lay the syringe and needle almost flat along the child's arm.

Figure 8-B: Position of syringe and needle



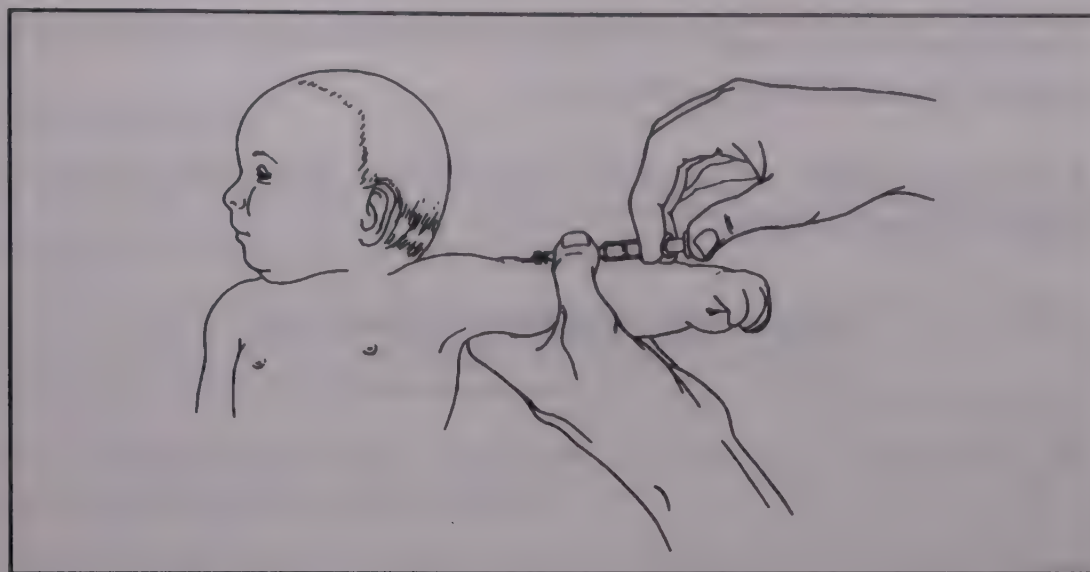
- 5) Insert the tip of the needle just under the skin – insert only the bevel and a little bit more.
- 6) Keep the needle FLAT along the arm, so that it goes into the top layer of skin only. Keep the bevel facing UP.

Figure 8-C: BCG needle position



- 7) Do NOT push too far and do NOT point down or the needle will go under the skin. If BCG is injected under the skin an abscess or enlarged glands may result.
- 8) To hold the needle in position, put your left thumb on the lower end of the syringe near the needle, but DO NOT touch the needle.
- 9) Hold the plunger end of the syringe between the index and middle fingers of your right hand. Press the plunger in with your right thumb.

Figure 8-D: Injecting BCG



- 10) Inject the vaccine and remove the needle.

If you have injected BCG correctly you will see a clear, flat-topped swelling on the skin, like a mosquito bite. The swollen skin may look pale with small pits.

When an intradermal injection is given correctly the plunger is hard to push.

If the vaccine goes in easily you may be injecting too deeply. In this event, proceed as follows:

- Stop injecting immediately, correct the position of the needle, and give the remainder of the dose but no more.
- If the whole dose has already gone under the skin, count the child as being injected. Do NOT repeat the dose.
- Ask the parent to return with the child if any side-effects, such as abscesses or enlarged glands, appear

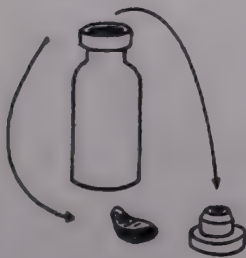
2. How to give an OPV immunization

2.1 Open the OPV container

Oral polio vaccine (OPV) comes in either a plastic dropper bottle or a glass vial with the dropper in a separate plastic bag.

To open a dropper bottle, remove the cap and put the bottle on the foam in a vaccine carrier to keep it cold.

Figure 8-E: Opening a glass vial



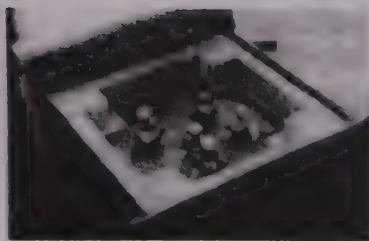
1. Remove the metal cap.
2. Remove the rubber stopper.



3. Cut open the plastic bag containing the dropper.



4. Fit the dropper on the open vial.



5. Put the dropper and vial on the foam in a vaccine carrier to keep them cold.

2.2 Position the child

Ask the parent to hold the child firmly, with the child lying on her or his back.

2.3 Give the OPV

- 1) Open the child's mouth by squeezing the cheeks gently between your fingers. This makes the child's lips point outward.
- 2) Hold the dropper over the child's mouth at an angle of 45°. Let two drops of vaccine fall from the dropper on to the child's tongue.

Note. The dosage may differ, depending on the brand of vaccine. If the child spits the vaccine out, give another dose.

Figure 8-F: Giving OPV, showing the dropper at an angle



Remember about oral polio vaccine:

- Give two drops on four occasions:
at birth; at 6 weeks; at 10 weeks; at 14 weeks.
- Oral polio vaccine is the most sensitive of the EPI vaccines.
Keep it on ice and check the vaccine vial monitor before use.

3. How to give a DPT immunization

The combination diphtheria-pertussis-tetanus (DPT) vaccine is usually given at the same time as OPV.

3.1 Prepare the DPT vaccine

- 1) Shake the vial so that the sediment at the bottom mixes completely with the liquid. If the toxoid is not well mixed the correct dose cannot be given.
- 2) If you suspect that the toxoid has been frozen and thawed, check for damage by using the shake test (see Module 3).
- 3) Remove the centre of the metal cap on the vial with a metal file.

3.2 Position the child

Ask the parent to remove any clothing from the child's right or left leg so that the thigh is bare.

The child should sit on the parent's lap as indicated below:

- The parent's left arm should be around the child, supporting her or his head and holding the outside arm.
- The child's inside arm should be tucked around the parent's body.
- The parent's right hand should hold the child's legs firmly.

Inject DPT vaccine into the thigh, NEVER into the buttock.

Figure 8-G: Holding child for DPT immunization



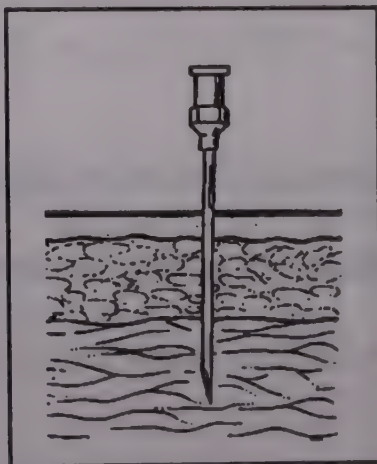
Injectations into the buttock: the buttock should not be used as an immunization site for children or women because there is a risk of injury to the sciatic nerve which can cause paralysis.

3.3 Inject the DPT vaccine

You need a sterile 1.0 ml syringe and a sterile 25 mm, 22 gauge reusable needle or a 25 mm, 23 gauge single-use needle.

- 1) Put your finger and thumb on the OUTER part of the middle of the child's thigh.
- 2) Stretch the skin flat between your finger and thumb.
- 3) Quickly push the needle straight down through the skin between your fingers. Go deep into the muscle.

Figure 8-H: Needle position for DPT



- 4) Press the plunger with your thumb to inject the vaccine.
- 5) Withdraw the needle and press the site with cotton wool.

Remember about DPT injections:

- Give 0.5 ml on three occasions:
 - at 6 weeks;
 - at 10 weeks;
 - at 14 weeks.
- Inject DPT into the child's thigh.
- Do not inject DPT (or any other vaccine) into the buttock.
- Do not freeze DPT.

4. How to give a hepatitis B immunization

Schedules vary among countries that give hepatitis B vaccine as part of their immunization programme. Some give a dose at birth, 6 weeks and 14 weeks; others do so at 6 weeks, 10 weeks and 14 weeks. Since other vaccines are also given at these times, make sure that you inject each vaccine in a different part of the child's body.

4.1 Prepare hepatitis B vaccine

- 1) Shake the vial so that the sediment at the bottom mixes completely with the liquid. If the toxoid is not well mixed the correct dose cannot be given.
- 2) If you suspect that the toxoid has been frozen and thawed, check for damage by using the shake test (see Module 3).
- 3) Remove the centre of the metal cap on the vial with a metal file.

4.2 Position the child

When hepatitis B vaccine is given at the same time as DPT vaccine it should be injected into the leg not used for DPT vaccine. Health workers usually inject DPT vaccine into the left thigh and hepatitis B vaccine into the right thigh.

Ask the parent to remove any clothing from the child's leg so as to uncover her or his thigh.

The child should sit on the parent's lap as indicated below:

- The parent's right arm should be around the child, supporting her or his head and holding the right arm.
- The child's left arm should be tucked around the parent's body.
- The parent's left hand should hold the child's legs firmly.

Figure 8-I: Holding child for hepatitis B immunization

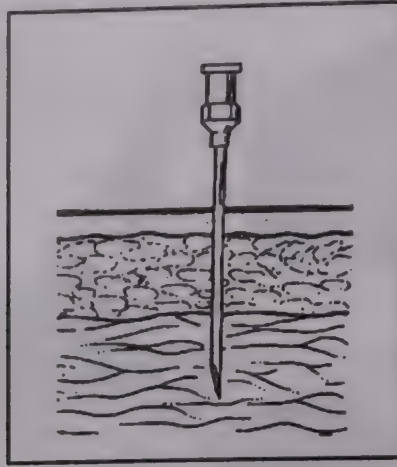


4.3 Inject hepatitis B vaccine

You need a sterile 0.5 ml syringe and a sterile 25 mm, 22 gauge reusable needle or a 25 mm, 23 gauge single-use needle.

- 1) Put your finger and thumb on the OUTER part of the middle of the child's thigh.
- 2) Stretch the skin flat between your finger and thumb.
- 3) Quickly push the needle straight down through the skin between your fingers. Go deep into the muscle.

Figure 8-J: Needle position for hepatitis B immunization



- 4) Press the plunger with your thumb to inject the vaccine.
- 5) Withdraw the needle and press the site with cotton wool.

Remember about hepatitis B injections:

- Give 0.5 ml in three doses in accordance with your programme's schedule.
- Inject hepatitis B vaccine into the thigh of a child, NEVER into the buttock.

5. How to give a measles immunization

Measles vaccine comes as a dry powder. Before you can use it you must reconstitute it with measles diluent (see Module 7).

5.1 Position the child

Clothing should be removed from the child's left upper arm so that the measles vaccine can be injected there. (Some health workers use the right arm.)

If the injection is to be made into the child's left arm he or she should sit on the parent's lap as follows:

- The parent's left arm should be around the child, supporting her or his head and holding the left shoulder.
- The child's right arm should be tucked around the parent's body.
- The parent's right arm should hold the child's legs out of the way, and the parent's right hand should hold the child's left hand.

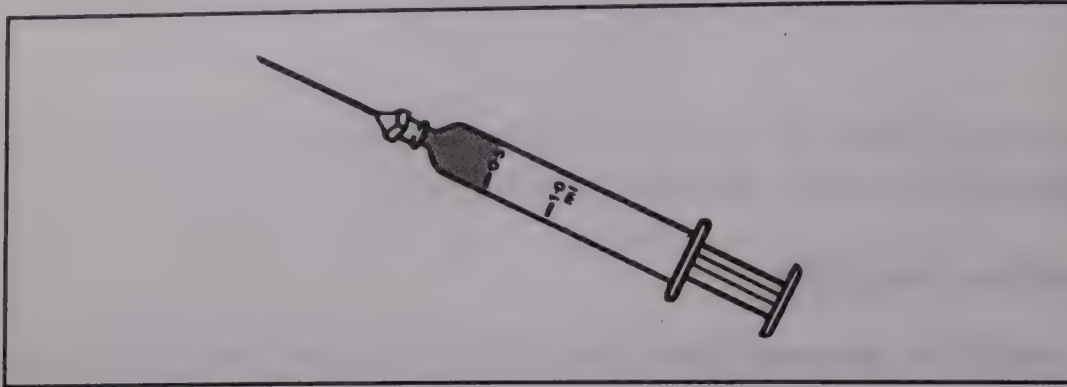
Figure 8-K: Holding child for measles immunization



5.2 Inject measles vaccine

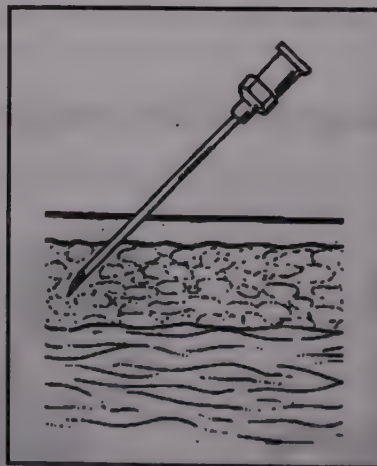
You need a sterile 0.5 ml syringe and a sterile 25 mm, 22 gauge reusable needle or a 25 mm, 23 gauge single-use needle.

Figure 8-L: Measles syringe and needle



- 1) Hold the child's arm from underneath. Your fingers reach around and PINCH UP the skin.
- 2) Push the needle into the pinched-up skin. The needle should go in at a sloping angle, not straight down.

Figure 8-M: Needle position for measles immunization



- 3) Do not push the needle too far in.
- 4) To control the needle, support the end of the syringe with your thumb and finger while you push the needle in. Do NOT touch the needle itself.

Figure 8-N: Giving measles vaccine



- 5) Press the plunger with your thumb to inject the vaccine.
- 6) Withdraw the needle and press the site with cotton wool.

Remember about measles injections:

- Give 0.5 ml once at nine months of age.
- Protect reconstituted measles vaccine from heat and sunlight.
- Destroy reconstituted measles vaccine after six hours.

6. How to give a yellow fever immunization

Routine yellow fever immunization is recommended in countries where this disease is endemic. Yellow fever vaccine is usually given at nine months of age, the same time as measles vaccine. Never give yellow fever vaccine to children below six months of age.

Like BCG and measles vaccines, yellow fever vaccine comes as a dry powder which, before use, must be reconstituted with the diluent that comes with it (see Module 7).

6.1 Position the child

Yellow fever vaccine should be injected into the arm that was NOT used for measles immunization. Health workers usually inject measles vaccine into a child's left arm and yellow fever vaccine into the right arm.

Clothing should be removed from the child's right upper arm.

The child should sit on the parent's lap as indicated below:

- The parent's right arm should be around the child, supporting her or his head.
- The child's left arm should be tucked around the parent's body.
- The parent's left arm should hold the child's legs out of the way, and the parent's left hand should hold the child's right hand.

Figure 8-O: Holding child for yellow fever immunization

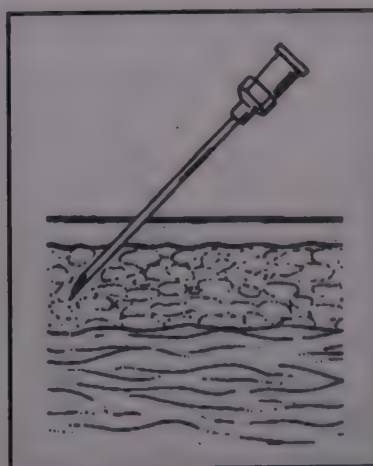


6.2 Inject yellow fever vaccine

You need a sterile 0.5 ml syringe and a sterile 25 mm, 22 gauge reusable needle or a 25 mm, 23 gauge single-use needle.

- 1) Hold the child's arm from underneath. Your fingers reach around and **PINCH UP** the skin.
- 2) Push the needle into the pinched-up skin. The needle should go in at a sloping angle, not straight down.

Figure 8-P: Needle position for yellow fever immunization



- 3) Do not push the needle too far in.
- 4) To control the needle, support the end of the syringe with your thumb and finger while you push the needle in. Do **NOT** touch the needle itself.

Figure 8-Q: Giving yellow fever vaccine



- 5) Press the plunger with your thumb to inject the vaccine.
- 6) Withdraw the needle and press the site with cotton wool.

Remember about yellow fever injections:

- Give 0.5 ml once at nine months.
- Yellow fever vaccine may be given at the same time as measles vaccine.
- Protect reconstituted yellow fever vaccine from heat and sunlight.
- Destroy reconstituted yellow fever vaccine after six hours.

7. Giving a tetanus toxoid immunization

Tetanus toxoid is given to women of childbearing age (or, in some countries, to pregnant women only).

7.1 Prepare tetanus toxoid

- 1) Shake the vial so that the sediment at the bottom mixes completely with the liquid. If the toxoid is not well mixed the correct dose cannot be given.
- 2) If you suspect that the toxoid has been frozen and thawed, check for damage by using the shake test (see Module 3).
- 3) Remove the centre of the metal cap on the vial with a metal file.

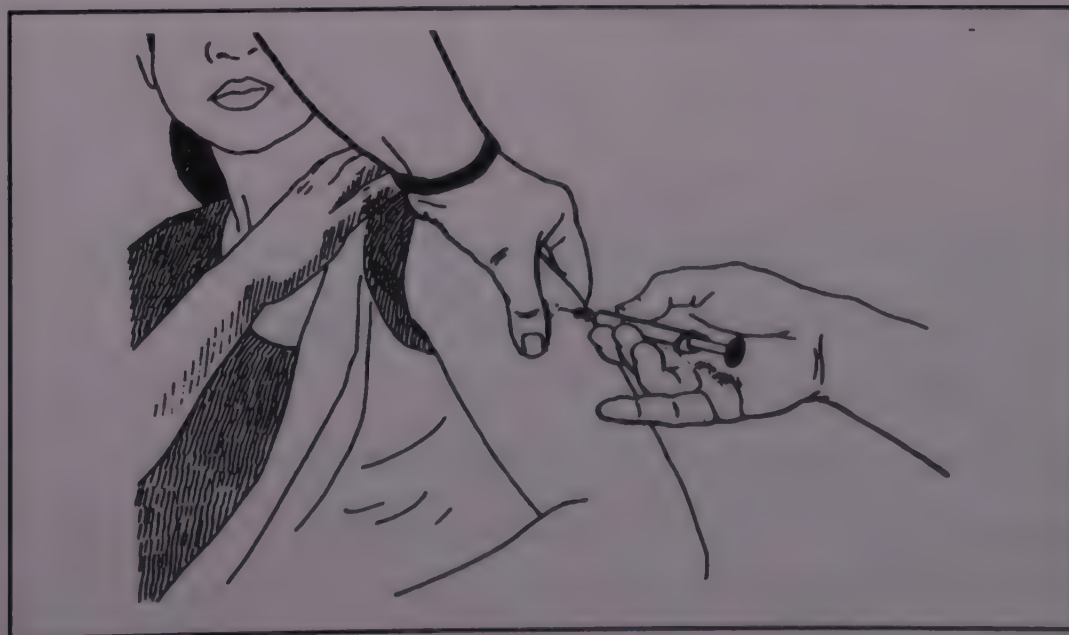
7.2 Inject tetanus toxoid

You need a sterile 0.5 ml syringe and a sterile 25 mm, 22 gauge reusable needle or a 25 mm, 23 gauge single-use needle. The syringe and needle are of the same sizes as those used for giving DPT and hepatitis B vaccines to children.

Ask the woman whether she prefers her immunization to be in her left or right arm.

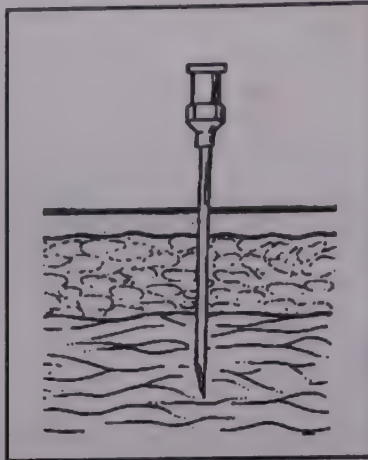
- 1) Put your finger and thumb on the OUTER part of the woman's upper arm.
- 2) Use your left hand to squeeze up the muscle of the arm.

Figure 8-R: Giving tetanus toxoid



- 3) Quickly push the needle straight down through the skin between your fingers. Go deep into the muscle.

Figure 8-S: Needle position for tetanus toxoid immunization



- 4) Press the plunger with your thumb to inject the toxoid.
- 5) Withdraw the needle and press the site with cotton wool.

Remember about tetanus toxoid (tt) injections:

- Give 0.5 ml on five occasions:
 - TT1 as soon as the woman reaches childbearing age or as early in pregnancy as possible;
 - TT2 at least four weeks after TT1;
 - TT3 at least six months after TT2;
 - TT4 at least one year after TT3;
 - TT5 at least one year after TT4.
- Do not freeze tetanus toxoid.

To avoid infection and injuries from unsafe injection practices:

- Use only sterilised needles and sterilised syringes.
- Use the appropriate injection technique.
- Handle used needles carefully to avoid needle-sticks.
- Dispose of used syringes and needles properly.

Immunization in practice

Module 9:

After a session

- * Revision 1, issued in September 1999, revises section 3, page 3, to reflect policy changes in the handling of multi-dose vials of vaccine.
These changes were initially issued as a corrigendum in April 1999:
WHO/EPI/TRAM/98.01-11 Corr.2.



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva
1998*

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About this module

This module, providing instructions on what to do after an immunization session, covers the following matters:

- **completing an immunization tally sheet;**
- **cleaning and sterilizing reusable syringes and needles;**
- **taking care of vaccines;**
- **disposing of used equipment;**
- **special tasks on completing an outreach session.**

1. Completing an immunization tally sheet

Health workers should keep a tally of each immunization they give, as specified in Module 11.

At the end of an immunization session, count the number of 0s deleted on the tally sheet for the day in question. This indicates the total number of immunizations you have given with each vaccine by dose.

Use daily tally sheets to prepare monthly reports to supervisors.

2. Cleaning and sterilizing reusable syringes and needles

You should have enough syringes and needles for there needs to be one sterile syringe and one sterile needle per injection during a session. The following considerations apply if you have reusable syringes and needles:

- The best practice is to clean and sterilize them immediately after each session.
- It is acceptable to clean them at the end of each session, load the sterilizer, and sterilize them the next morning.

If you have been working at an outreach site you may be able to store sterilizing equipment there and train local people to use it and keep sterilized syringes and needles in a sterile environment between sessions.

- Sterilizing DURING sessions is not recommended. This should only be done if you do not have enough reusable syringes and needles for a whole session.

It takes 20 minutes to sterilize injection equipment and an additional period is required for it to cool before use. Consequently, if you sterilize during a session you may have to stop immunization activities for an hour or more.

Remember that if you need to sterilize during an outreach session you must have a steam sterilizer, a stove and other equipment.

Further information on sterilization equipment and its use is given in Module 4.

You must use one sterile syringe and one sterile needle for each injection.

The best practice is to have sufficient sterile syringes and needles to allow you not to sterilize during a session.

3. Taking care of vaccines

In the past all vaccine vials that had been opened for an immunization session were thrown away at the end of the session, regardless of the type of vaccine or the number of doses left in the vials. Recent research has shown that this is not necessary for all vaccines.

3.1 Liquid vaccines - OPV, DPT, TT, DT, Td, hepatitis B, and liquid formulations of Hib

You may use opened multi-dose vials of liquid vaccines from which one or more doses have been removed following standard sterile procedures, in the next immunization session, *if all of the following conditions are met:*

- a) The expiry date has not passed; and
- b) The vaccine has not been contaminated; and
- c) The vials have been stored under appropriate cold chain conditions; and
- d) The VVM on the vial, if attached, has not reached the discard point.

3.2 Freeze-dried vaccines - BCG, measles, yellow fever, and freeze-dried formulations of Hib

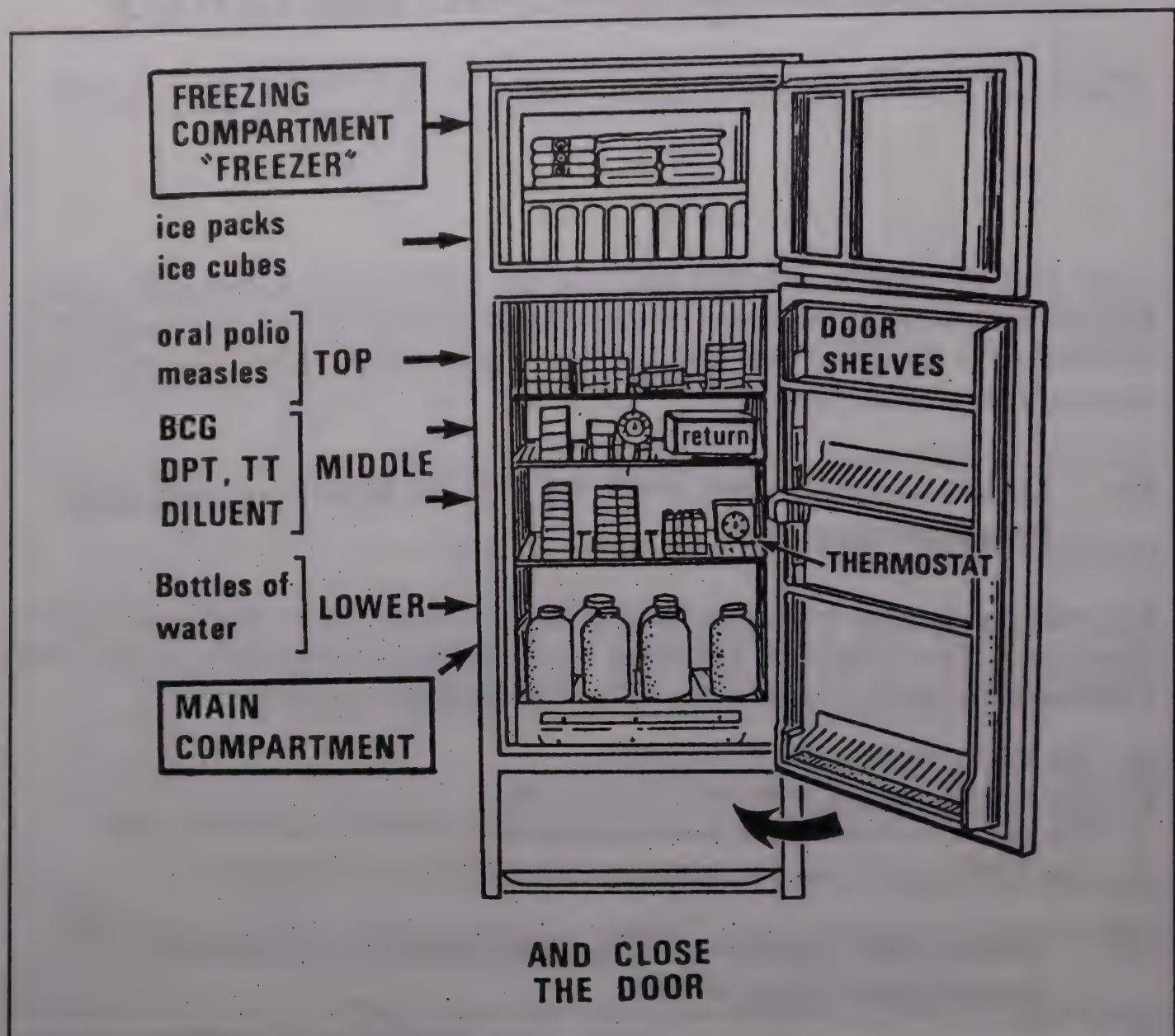
You must discard freeze-dried vaccines six hours after reconstitution or at the end of the immunization session, whichever comes sooner.

3.3 All vaccines

You must discard an opened vial of any vaccine (including single dose and multi dose, liquid and freeze dried) immediately if any of the following conditions applies:

- Sterile procedures have not been followed; or
- You see evidence of contamination, such as floating particles in the vaccine; or
- You just suspect that the vaccine has been contaminated.

Figure 9-A: Vaccine refrigerator, highlighting the "returned" box



Remember:

If the vaccine vial monitor on a vial shows that the vaccine inside has been exposed to unacceptably high temperatures, dispose of the vaccine.

Dispose of BCG, measles and yellow fever vaccines if they have not been used within six hours of reconstitution.

Dispose of DPT vaccine, hepatitis B vaccine and tetanus toxoid if they have been frozen.

4. Disposing of used equipment

If you have single-use syringes and needles they must be destroyed by burning as described in Module 4.

Wrap empty vials, other vials and rubbish in newspaper or other paper. Then either bury or burn them if the local government does not collect them.

5. Special tasks on completing an outreach session

After an outreach session you have tasks that are additional to those following a session at a fixed site, as described below.

5.1 Packing the vaccine carrier

- Check the ice packs to make sure that the ice has not melted.
- Pack only unopened vaccines.

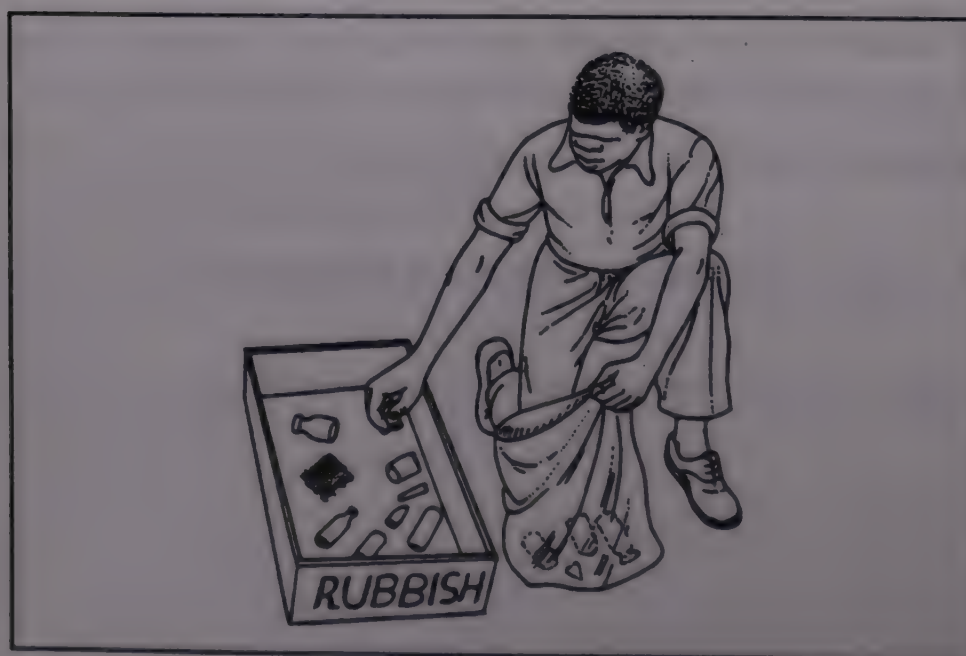
Note: You cannot use opened vaccines of any kind after an outreach session.

- Put empty vials and opened vials in a separate container to carry them back to the health centre for disposal.

5.2 Leaving the outreach site

- Collect your rubbish and take it back to the health centre.
- Do not leave empty or opened vials at the site.
- Do not leave any syringes or needles at the site. As soon as they have been used, single-use syringes and needles should be placed in a disposal container and this should be taken back to the health centre.

Figure 9-B: Collecting rubbish



-
- Clean the site.
 - Return tables, chairs and other equipment to their owners.
 - Thank the local people who have helped to organize the session and remind them when you will return.

5.3 Returning unopened vaccines to the refrigerator

Note: You may use unopened vials that you have taken on outreach only if the ice packs in your vaccine carrier are still frozen when you return to the health centre.

- If the ice packs are still frozen, put unopened vials in the "returned" box in the refrigerator so that they will be used first during the next session.
- If the ice in the ice packs has melted, discard all the vaccines EXCEPT for any in vials carrying vaccine vial monitors that have not changed colour. Return these vaccines to the refrigerator for use during the next session.
- Put the ice packs from the carrier into the freezer, and check and record the temperature of the refrigerator.

5.4 Cleaning the vaccine carrier

After taking care of its contents, wipe the carrier with a damp cloth and check it for cracks. Repair any cracks with tape and leave the carrier open to dry.

Remember:

Do not leave ANY syringes and needles at an outreach site.

Take ALL your rubbish back to the health centre.

Leave the outreach site clean and tidy.

Immunization in practice

Module 10:

Communicating with parents and involving communities



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva
1998*

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About this module

This module deals with communication between parents (or clients) and health workers and contains suggestions for involving communities in immunization programmes. Additional information is given in the manuals *How to Communicate with Mothers about Immunizations* and *How to Gather and Use Information from the Community*.

1. Communication in general

Communication means delivering messages that can be understood. Health workers not only give messages **to** parents but also receive messages **from** them. In both cases, communication takes place only when the messages are understood.

To make sure that your communication is effective:

- find out what the person you are communicating with already knows, and use terms that he or she understands;
- do not rush;
- acknowledge what the person says or indicates;
- make sure that the person understands you by asking questions that require answers other than "yes" or "no".

If you ask "Do you understand?" and someone answers "Yes" you cannot be sure that he or she really does understand.

If you ask "When will you bring your child for his next immunization?" and someone answers with the right date, you know that he or she has understood you.

2. Addressing the concerns of clients first

People may come to a health centre or outreach site for some reason other than to seek immunization. For example, a woman may have a sick child or may be worried about her pregnancy. Respond to the patient's concerns at the outset, by giving advice or providing treatment, then screen and, if appropriate, immunize.

Find out whether people have any particular concerns about immunizations and answer these questions straight away. For example, if a woman believes false rumours that tetanus toxoid is a contraceptive she will not care about anything else you have to say. Talk to her about this first of all.

3. The five essential messages about immunization

There are five essential messages that parents, and women of childbearing age who may not be parents, must receive if they or their children are to be fully protected against the EPI diseases.

3.1 The date and time of the next immunization

Be specific. Name the day, e.g., Monday, and the date, e.g., 4 August. Say how many weeks ahead the date is, e.g., "four weeks from today".

If calendars are not commonly used, give other reference points as reminders, for instance phases of the moon, festivals or other community events.

If you want to set a particular time of day for immunization, come to an agreement about this with the client.

Give the client a written note of the date and time of the next immunization if doing so is likely to be helpful.

3.2 The place of the next immunization

Tell the client where to attend for the next immunization. This is particularly important if you are changing locations.

3.3 The number of visits a child still needs in order to be fully immunized; the number of doses a woman receiving tetanus toxoid still needs

Tell parents how many more visits are needed before their children are fully immunized. Tell women of childbearing age how many more times they have to return in order to secure full protection.

When people make subsequent visits you can help them to feel a sense of accomplishment by praising them for the immunizations they have already received.

3.4 What side-effects may occur

Tell parents what side-effects can be expected for each vaccine given.

If you are giving several vaccines at once, explain the side-effects of each.

3.5 How side-effects can be treated

Advise parents what to do about side-effects if they occur and when to seek professional help.

Each of these messages should be given more than once. The likelihood of their being remembered increases if they are given by different health workers, for example the one giving immunizations and the one completing the paperwork at the departure point. Check clients' understanding by asking questions.

Advice to parents on side-effects:

The BCG sore is normal. Do not put anything on it. It heals by itself and a scar develops.

- **Fever may occur after some injections. This is normal.**
- **Soreness may occur at the injection site. It will disappear after three or four days.**
- **A rash may develop following an injection of measles vaccine. This is normal.**
- **If an abscess develops after an injection, put a dry dressing on it.**
- **Return to the health centre if a side-effect seems serious or continues for more than a few days.**

4. Communicating with groups

Another opportunity for communicating about immunization occurs when groups of people are gathered together, perhaps waiting for immunization or attending community meetings.

The key to communicating effectively with groups is to address the shared interests of the group members. As with individuals, you should deal with group members' concerns at the outset.

Figure 10-A: A group discussion

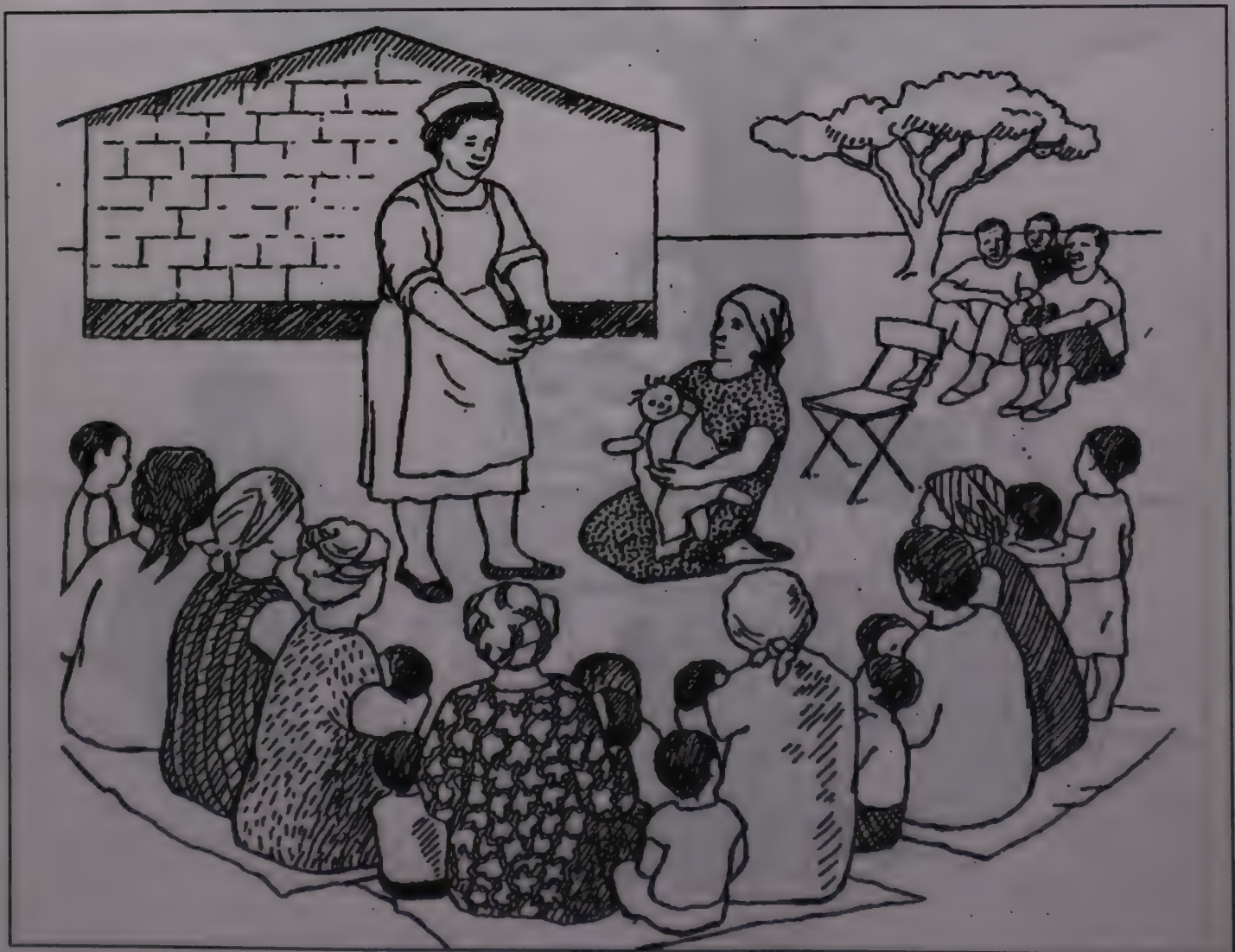


4.1 Group discussion techniques

Discussion provides an effective way to obtain and give information or ideas. Some ways in which you can encourage discussion are indicated below.

- Ask people about their experiences in dealing with a problem or about their knowledge of a topic.
Remember, however, that you are not giving them a test.
- Invite them to ask you questions.
- You do not have to know all the answers. Share the knowledge you have. If you are not sure about something, say so. You can look it up in a book or find out from someone else and respond at the next meeting.
- Tell stories and ask people what they think happened in them, and why.
- Sing songs or encourage people to make up their own songs
- Put on short plays about immunization and encourage group members to create one of their own.

Figure 10-B: Health workers giving a play



- Use visual aids such as pictures to illustrate what you are talking about.
Before using a visual aid, test it on people in the community to make sure that they understand your message. If they do not, change the visual aid.

5. Involving the community in planning immunization services

If a community is to be fully protected against the EPI diseases you have to gain its support. You cannot achieve everything on your own.

- 1) Spend time with local government officials and traditional leaders. They can help you to decide:
 - when to hold sessions;
 - where to hold outreach sessions;
 - whom to seek as a contact person who can mobilize the community and help you during sessions.
- 2) Keep in touch with your local contact person. He or she can help you to remind parents when to bring their children for immunizations, can encourage women to obtain their tetanus toxoid immunizations, and can explain to clients what is going on during sessions. The contact person can also help you to organize outreach sessions and, after having been trained, can sterilize reusable syringes and needles.
- 3) Train local people to help you with the organization of patient flow, the completion of immunization cards, the administration of oral polio vaccine, the provision of health education, and other tasks.
- 4) Give feedback to people in the community on the number of children fully immunized, the number of newborns protected from neonatal tetanus, and coverage in percentage terms. Also report to them on disease incidence in the community. Feedback encourages them to identify problems and solutions.

Working with people

- Recognize the knowledge and experience of people and help them to learn from others.
- Talk *with* people, *not to* them.

Immunization in practice

Module 11:

Monitoring immunization coverage



**GLOBAL PROGRAMME FOR VACCINES AND IMMUNIZATION
EXPANDED PROGRAMME ON IMMUNIZATION**



*World Health Organization
Geneva
1998*

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About this module

The purpose of monitoring immunization coverage is to determine how many immunizations are performed in a given period. Through monitoring you can assess how well you are doing and what improvements you should make. By reporting coverage to your supervisors you inform them of your progress and help them to plan how to support you.

The following activities are associated with monitoring immunization coverage:

- recording immunizations when they are given;
- reporting coverage;
- using an immunization monitoring chart;
- interpreting coverage data;
- identifying problems and their causes;
- taking action to increase coverage.

1. Recording immunizations when they are given

Every health centre needs a system for keeping track of immunizations. Health workers record each client's immunizations in patient registers and on immunization cards.

Tally sheets help health workers to count the number of immunizations they give with each vaccine and each dose in a day. They are used for recording:

- children's immunizations;
- tetanus toxoid immunizations;
- children protected at birth from neonatal tetanus.

Following is a sample tally sheet with instructions for use.

Figure 11-A: Tally sheet

SAMPLE

Health Centre: _____ Date: _____

Daily Tally Sheet
For Recording Immunizations and
Children Protected At Birth Against Neonatal Tetanus

	Children Under one year of age	TOTAL	Children Over one year of age	TOTAL
BCG	0000 0000 0000		0000 0000 0000	
OPV Zero	0000 0000 0000		0000 0000 0000	
OPV 1	0000 0000 0000		0000 0000 0000	
OPV 2	0000 0000 0000		0000 0000 0000	
OPV 3	0000 0000 0000		0000 0000 0000	
DPT 1*	0000 0000 0000		0000 0000 0000	
DPT 2	0000 0000 0000		0000 0000 0000	
DPT 3	0000 0000 0000		0000 0000 0000	
Measles	0000 0000 0000		0000 0000 0000	

*All children who receive DPT 1 should be assessed for protected at birth against neonatal tetanus

Women of childbearing age

	Pregnant	TOTAL	Non-Pregnant	TOTAL
TT 1	0000 0000 0000 0000 0000 0000		0000 0000 0000 0000 0000 0000	
TT 2	0000 0000 0000 0000 0000 0000		0000 0000 0000 0000 0000 0000	
TT 3	0000 0000 0000 0000 0000 0000		0000 0000 0000 0000 0000 0000	
TT 4	0000 0000 0000 0000 0000 0000		0000 0000 0000 0000 0000 0000	
TT 5	0000 0000 0000 0000 0000 0000		0000 0000 0000 0000 0000 0000	

Children protected at birth against neonatal tetanus

Child IS protected against neonatal tetanus at birth	TOTAL	Child NOT protected against neonatal tetanus at birth	TOTAL
0000 0000 0000		0000 0000 0000	
0000 0000 0000		0000 0000 0000	

Instructions follow for completing a tally sheet.

1.1 Record children's immunizations

After you have immunized a child, record the date on her or his immunization card (see Module 8) and **cross off one of the 0s on the tally sheet**. If the child is under 1 year of age, cross off a 0 in the column headed "Children under 1 year of age". If the child is older, cross off a 0 in the other column.

Figure 11-B: Portion of a tally sheet with "0's" crossed off

PLACE: Mugumo Village				DATE: 14 July 1986		
Less than 1 year old				1 year and older		
BCG	0000	00000	00000	00000	00000	00000

1.2 Record tetanus toxoid immunizations

After you have immunized a woman, record the date on her immunization card (see Module 8) and cross off one of the 0s in the tetanus toxoid section of the tally sheet. If the woman is pregnant, cross off a 0 in the column headed "Pregnant". If she is not, cross off a 0 in the "Non-pregnant" column.

1.3 Record children protected at birth from neonatal tetanus

When a child receives DPT1 vaccine you should determine whether he or she was protected at birth against neonatal tetanus. If all women of childbearing age are up-to-date with their tetanus toxoid immunizations, then all children brought for DPT1 will have been protected at birth against neonatal tetanus.

Ask every mother who comes with a child for a DPT1 immunization for her immunization card.

If she has a card:

- 1) Check how many **valid** doses of tetanus toxoid she has received. A dose is valid when the minimum required interval between doses has been observed, as shown below.

Between doses	Minimum interval
TT1 and TT2	4 weeks
TT2 and TT3	6 months
TT3 and TT4	1 year
TT4 and TT5	1 year

- 2) Determine the **period of protection** given by the number of doses the mother has had.

Number of valid doses	Period of protection
One	None.
Two	3 years, starting 15 days after the date of the second dose.
Three	Three
Four	10 years, starting 15 days after the date of the fourth dose.
Five	All the children years.

3) Ask when the child who is receiving DPT1 was born.

- If the child was born **during** the period of protection provided by the last valid dose, cross off a 0 in the “Child protected at birth” column of the tally sheet.
- If the child was born **after** this period of protection, cross off a 0 in the “Child not protected at birth” column.

4) Check the woman's immunization card to see whether she is eligible for a dose of tetanus toxoid.

- If she is eligible, immunize her, record the date on her immunization card, and cross off a 0 in the correct column of the tally sheet.
- If she is NOT eligible, tell her when to return for her next dose of tetanus toxoid.

If she does NOT have a card:

- 1) Cross off a 0 in the “Child not protected at birth” column of the tally sheet.
- 2) Immunize the woman with TT1. Give her an immunization card and enter the date on the card for TT1.
- 3) Cross off a 0 for TT1 in either the “Pregnant” or “Non-pregnant” column of the tally 32 sheet.

1.4 Complete the tally sheet at the end of a session

At the end of each immunization session, count the number of 0s that you have crossed off. This tells you the number of immunizations you have given with each vaccine and each dose.

Remember:

- Mark the tally sheet each time you give a vaccine.
- If you wait you may forget.

2. Reporting coverage monthly

At the end of each month, every health centre should complete and submit an immunization coverage report to its district. Prepare the monthly report as indicated below.

- 1) Gather all the tally sheets completed during the month.
- 2) Add together the numbers of immunizations given, by vaccine and dose, to:
 - children under 1 year of age;
 - children above 1 year of age;
 - pregnant women;
 - non-pregnant women of childbearing age.
- 3) Add the number of children that you assessed during the month as having been protected at birth.
- 4) Fill in a monthly immunization report form (see below).
- 5) Use the numbers to complete immunization monitoring charts (see below).
- 6) Give a copy of the report to your supervisor by the due date.

Figure 11-C: Monthly immunization report

EXERCISE : A and E

Immunization Monitor Chart

Health Facility: _____ Annual target population: _____

Year: _____ Vaccine: _____ Minimum coverage target for the year: _____

Monthly Target Population

Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	
												Total immunized this month
												Cumulative total for the year
												Total immunized this month
												Cumulative total for the year

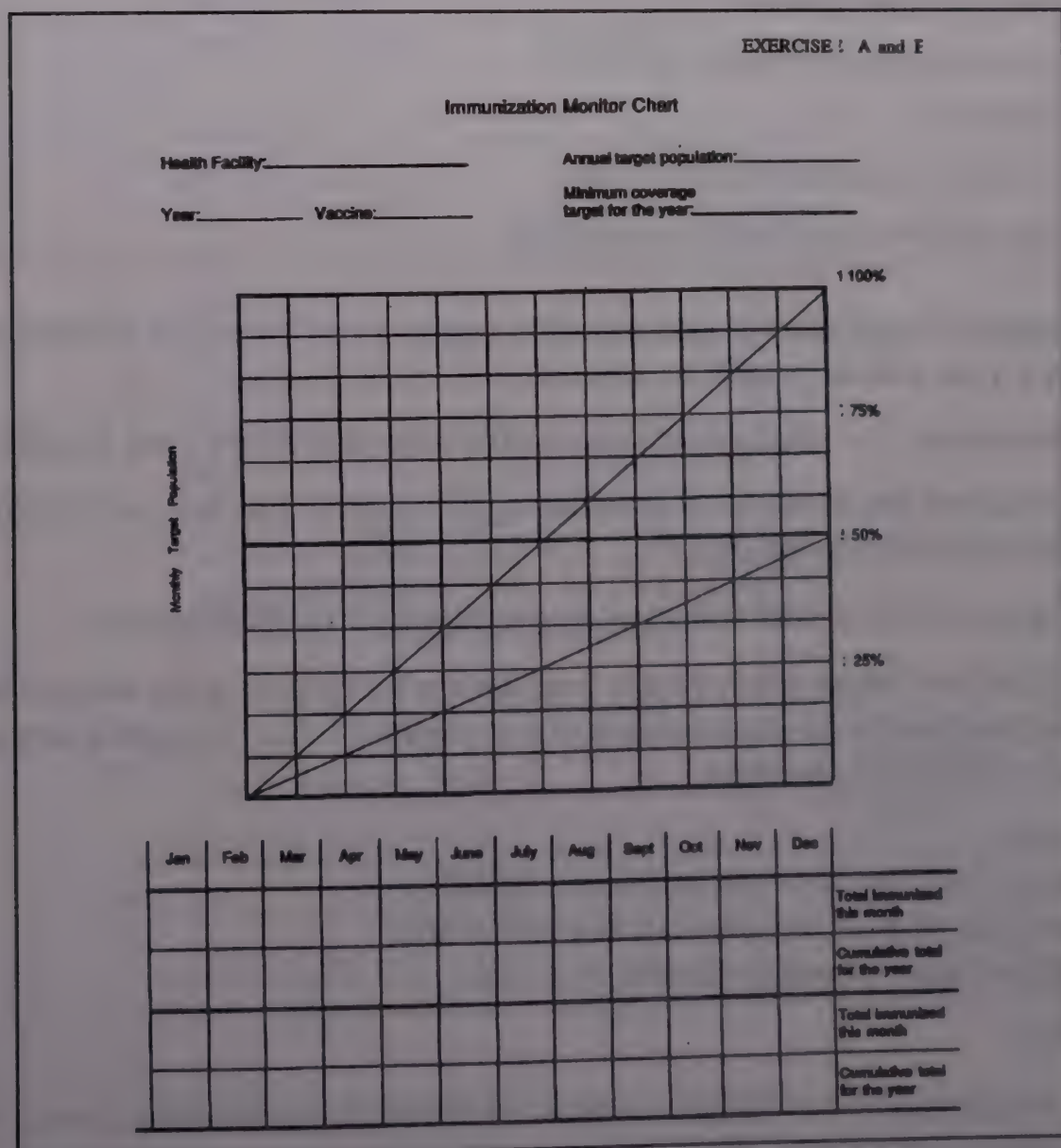
3. Using an immunization monitoring chart

An immunization monitoring chart shows the progress you are making in raising immunization coverage in your health centre catchment area. It summarizes the information given in monthly immunization reports (see above).

This chart enables you to compare the number of people you actually immunize each month with your coverage targets.

A blank immunization monitoring chart is shown below, and instructions follow for preparing and using it for children's and tetanus toxoid immunizations and for assessments of protection at birth.

Figure 11-D: Immunization monitoring chart



Instructions for using immunization monitoring charts are given below:

3.1 Prepare the charts

At the beginning of the year you need a blank immunization monitoring chart for each of the following:

- BCG;
- DPT1 and DPT3;
- OPV1 and OPV3;
- measles vaccine;
- hepatitis B, yellow fever and other vaccines, if appropriate;
- TT2+;
- the number of children protected at birth against neonatal tetanus compared to the number of children who received DPT1.

Prepare each chart as follows.

- 1) Determine the monthly and annual target populations as described in the box below.
- 2) At the top of each chart enter:
 - the name of the health centre;
 - the year;
 - what is monitored on the chart;
 - the total annual target population.

Determination of annual and monthly target populations of children aged under 1 year and of pregnant women:

- Determine the total population in the area served by your health centre.
- Calculate the number of children aged under 1 year by multiplying the total population by 0.03.

Total population \times 0.03 = annual target population of children.

- Calculate the monthly target population by dividing the annual target population by 12 **Annual target population \div 12 = monthly target population of children.**

Example:

Total population of catchment area: 10 000.

Annual target population: $10\,000 \times 0.03 = 300$.

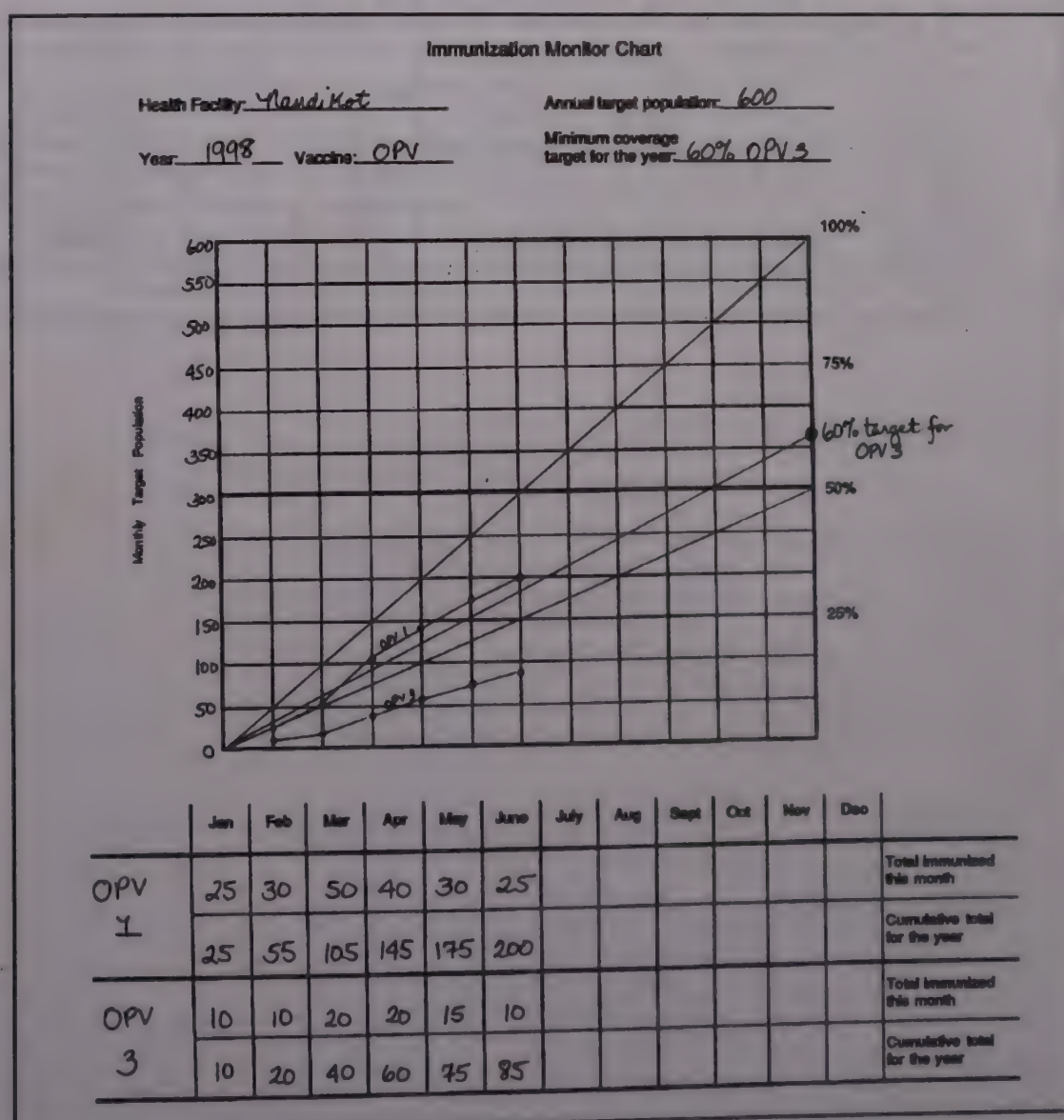
Monthly target population: $300 \div 12 = 25$.

Notes :

- a) If you know the actual percentage of children aged under 1 year, use this figure instead of 0.03.
- b) For pregnant women use the figure you calculate for children.

- 3) Write the minimum coverage target for the year on each chart.
 - The coverage target for a **children's vaccine** is the target set for a specific dose. For example, for OPV the coverage target is set for OPV3.
 - The coverage target for **tetanus toxoid** is the target set for TT2+ for pregnant women. TT2+ includes all **tetanus toxoid** doses except the first one (TT1); in other words the TT2, TT3, TT4 and TT5 immunizations are added together.
 - The coverage target for **children protected at birth** is the number of children who receive DPT1.
- 4) Label the left side of the charts with the monthly target population.
- 5) Write the cumulative numbers of people in the target population on the left side of each chart (see above for the calculation of the monthly target population).

Figure 11-E: Immunization monitoring chart, focusing on left side



- 6) Children's immunization charts, the tetanus toxoid chart, and the protection at birth chart are prepared in different ways. Below an example of each of these charts is followed by instructions.

Figure 11-F: Immunization monitoring chart - OPV1 and OPV3

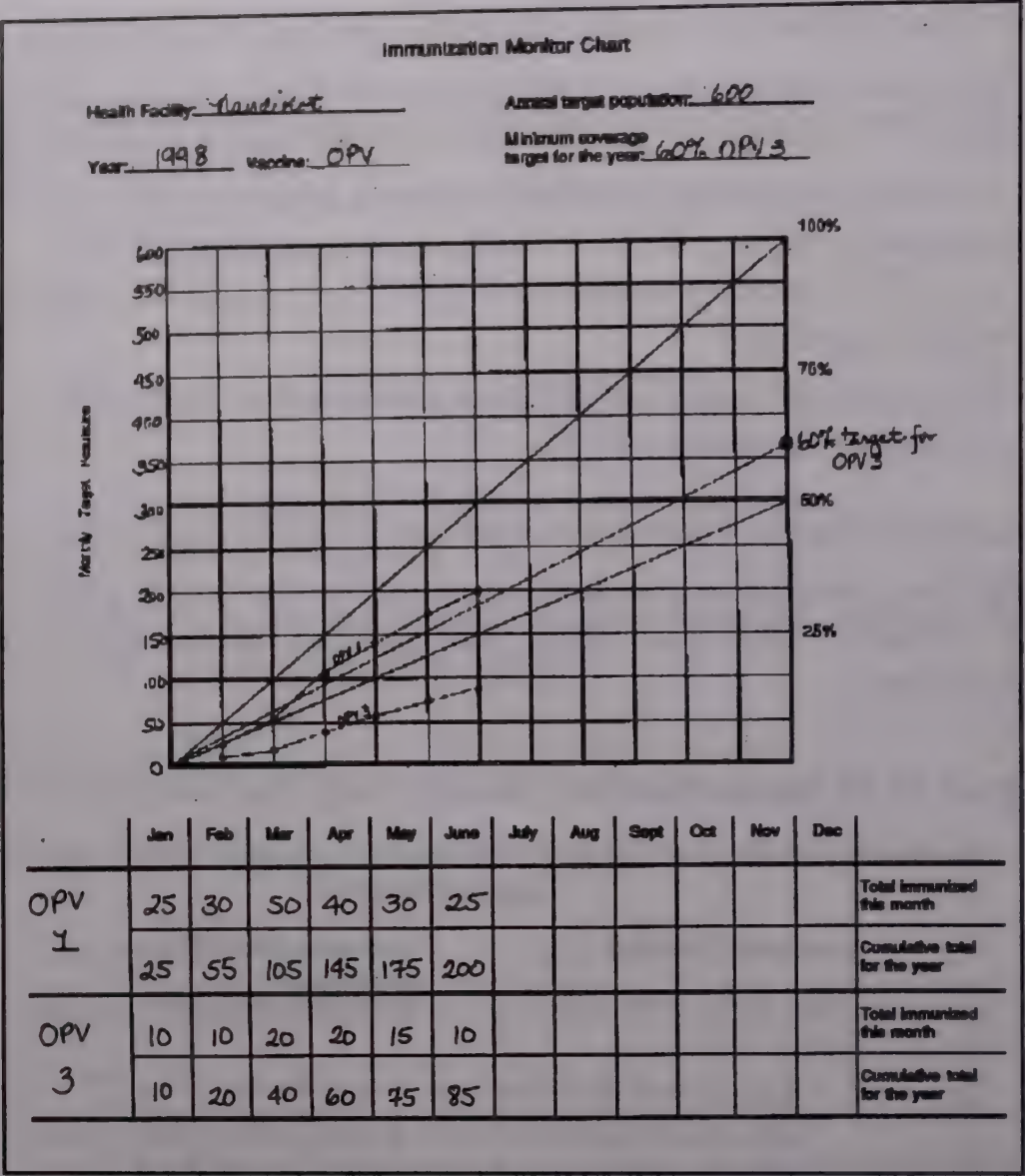


Figure 11-G: Immunization monitoring chart - TT2+

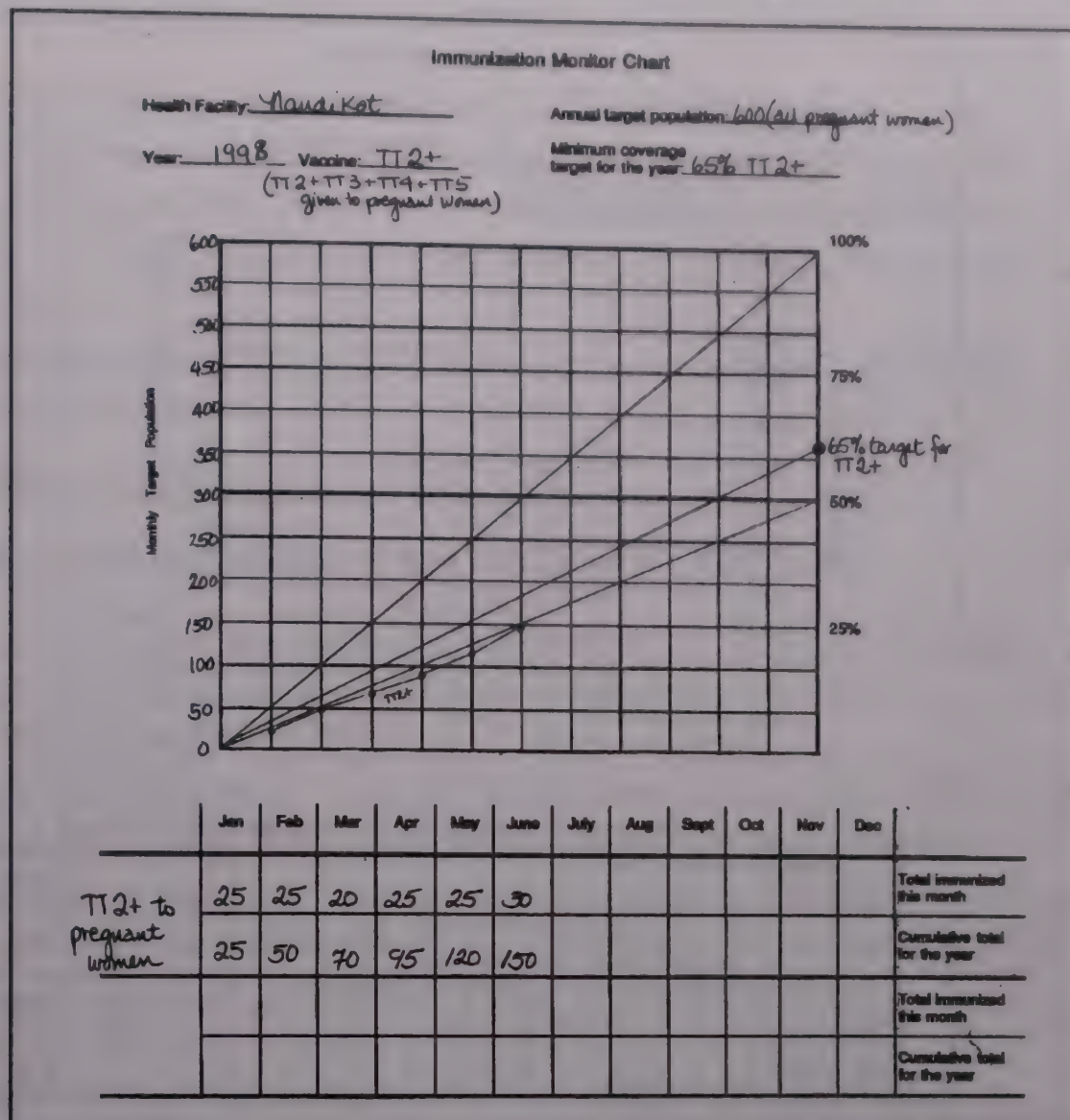
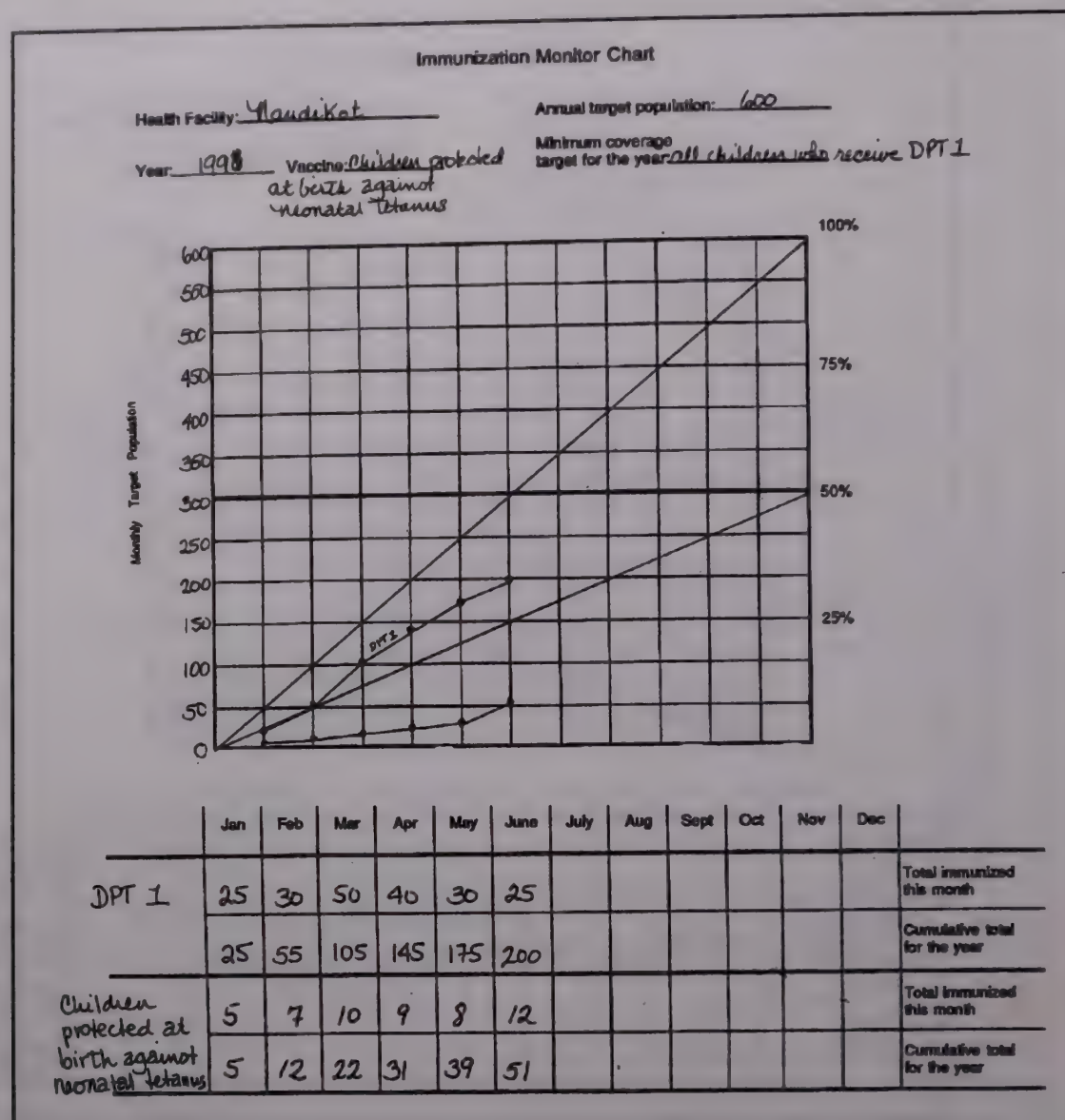


Figure 11-H: Immunization monitoring chart - children protected at birth



Instructions for preparing immunization monitoring charts are given below:

Children's immunization charts

To complete the preparation of these charts proceed as follows:

- 1) Draw a line showing the **minimum immunization coverage target**. The right side of the graph shows percentages (25%, 50%, 75%, 100%) for coverage targets.
- 2) Find the point that represents the coverage target for your catchment area. Make a dot at this point.
- 3) Draw a straight line from 0 in the left corner of the chart to this dot, and label it.
- 4) Label the boxes at the bottom of the chart with the name of the vaccine and the dose, as shown.

Tetanus toxoid chart

To complete the preparation of this chart proceed as follows:

- 1) Draw a line showing the minimum TT2+ coverage target.
- 2) Find the point on the right side of the graph that represents the TT2+ coverage target for your catchment area. Make a dot at this point.
- 3) Draw a straight line from 0 in the left corner of the chart to the dot, and label it as shown.
- 4) Label one row of boxes "TT2+ to pregnant women" at the bottom of the chart, as shown.

Protection at birth chart

To complete the preparation of this chart proceed as follows:

- 1) Since the target for protection at birth is all children who have received DPT1, you show **actual** DPT1 coverage when you fill in the chart every month. See section 3.2 below.
- 2) Label the first row of boxes at the bottom of the chart "DPT1". Here you record the number of children who receive DPT1 each month.
Label the second row "children protected at birth". In this row you record the number of children receiving DPT1 who were **also** protected at birth.

You are now ready to enter monthly data on the charts.

3.2 Fill in the immunization monitoring charts monthly

Children's vaccines charts

To record monthly progress on the charts for children's vaccines, use data from the monthly immunization reports as follows.

- 1) In the boxes under the graph, find the box for the vaccine, dose and month you are recording. Write down the total number of children under 1 year of age who received the dose during the month.
For example, on the above chart for OPV1 and OPV3 the total number of children aged under 1 year who were immunized with OPV1 in June was 25.
- 2) Add the current month's total to the last cumulative total to obtain the current cumulative total.
For example, on the chart for OPV1 and OPV3 the number 25 (children immunized with OPV1 in June) was added to 175 (cumulative OPV1 total for May) to obtain a current cumulative total of 200.
- 3) On the graph, make a dot for the cumulative total on the line for the month.
- 4) Connect the new dot to the previous month's dot with a straight line.

Tetanus toxoid chart

To record monthly progress on this chart proceed as follows:

- 1) In the box for the month you are recording, enter the total number of pregnant women who received TT2+ during the month. Obtain the data from the monthly immunization report.

For example, on the above chart for TT2+ the total number of pregnant women who were immunized with TT2+ in June was 30.

- 2) Add the current month's total to the last cumulative total to obtain the current cumulative total.

For example, on the above chart for TT2+ the number 30 (women immunized with TT2+ in June) was added to 120 (cumulative total for May) to obtain a current cumulative total of 150.

- 3) On the graph, make a dot for the cumulative total on the line for the month.
- 4) Connect the new dot to the previous month's dot with a straight line.

Chart for children protected at birth against neonatal tetanus

To record monthly progress on this chart proceed as follows:

- 1) In the row labelled DPT1 under the graph, enter the numbers you put in the DPT1 box on the DPT immunization monitoring chart.
- 2) In the row for "children protected at birth", find the correct month and enter the total number of children protected at birth as given in the monthly immunization report.

For example, on the above chart for children protected at birth the total number protected when the assessment took place in June was 12.

- 3) Add the current month's total to the last cumulative total to obtain the current cumulative total.

For example, on the above chart for children protected at birth the number 12 (children protected in June) is added to 39 (cumulative total for May) to get a current cumulative total of 51.

- 4) On the graph, make a dot for the DPT1 cumulative total and another dot for the "children protected at birth" total for the month that you are recording.
- 5) Connect the new dots to the previous month's dots with straight lines.

After three or four months your progress will be evident from the lines and numbers on your chart. Section 4 explains how to interpret the data.

4. Interpreting coverage data

After several months your immunization monitoring charts for children's vaccine and tetanus toxoid show you the percentage of people you are immunizing, whether it is increasing or decreasing, and how the number of immunizations given compares with targets.

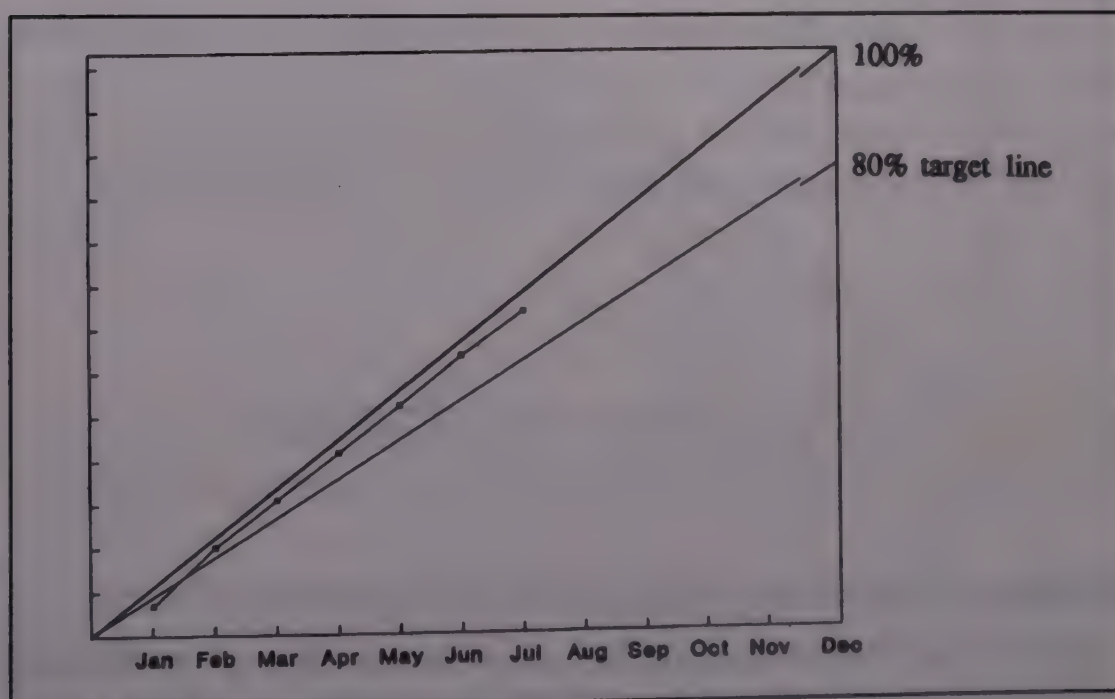
If you are not reaching your targets you should try to identify the reasons and decide how to solve the problems, as described in sections 5 and 6 below:

4.1 Children's vaccines and tetanus toxoid

After you have completed immunization monitoring charts for OPV1 and OPV3, DPT1 and DPT3, BCG and measles, and TT2+, as described in section 3 above, analyse the results.

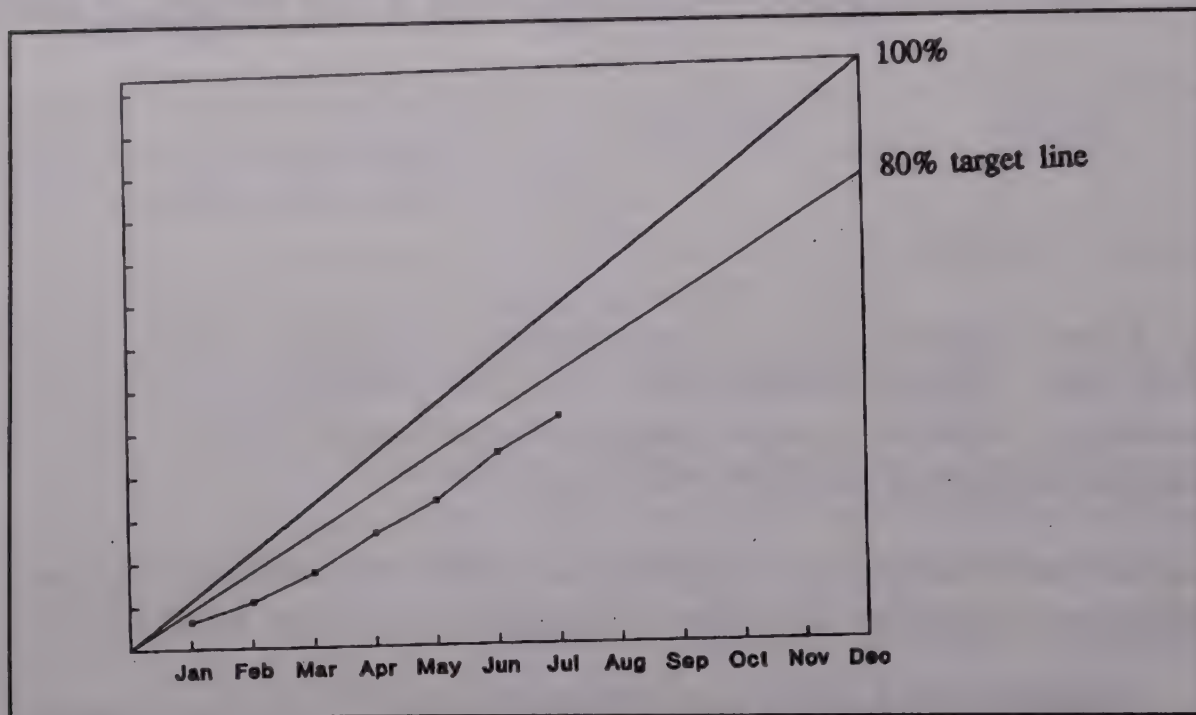
- 1) Compare the cumulative total line on the graph with the coverage target line
 - If the cumulative total line is **on or above** the target line, you are making good progress. In the figure below, the cumulative total is above the 80% target.

Figure 11-I: Cumulative total line above target line



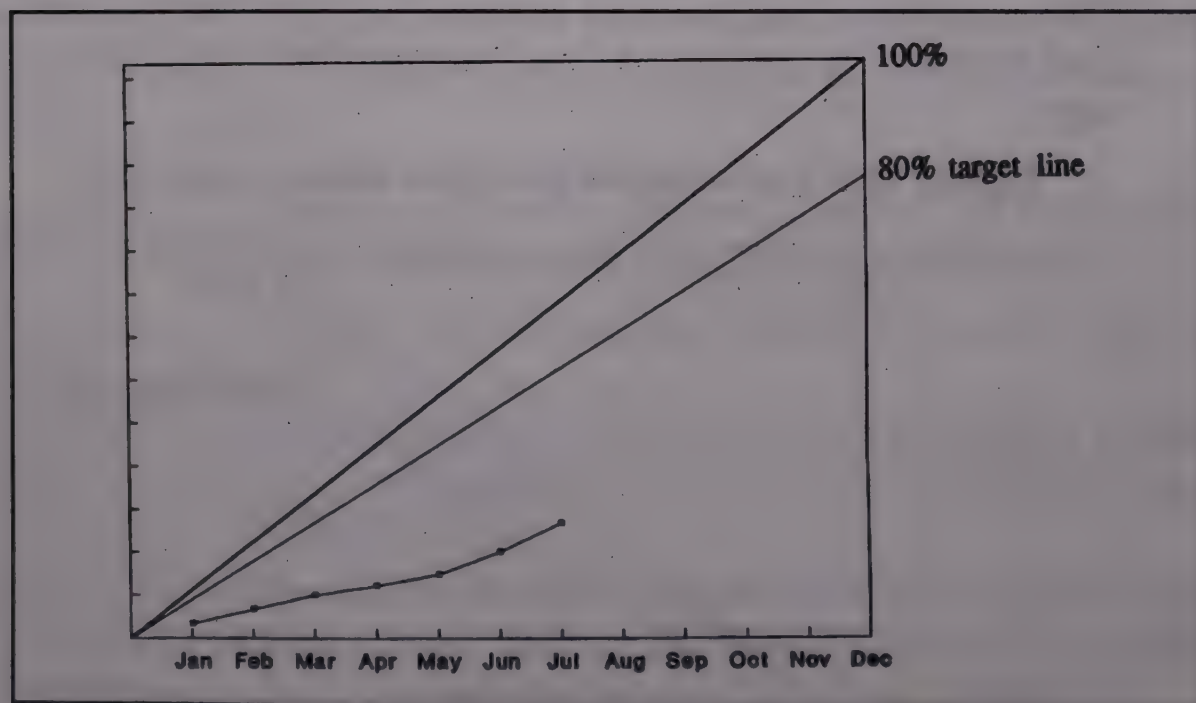
- If the cumulative total line is **below** but close to the target line you are making fair progress.

Figure 11-J: Cumulative total line below target line



- If the cumulative total line is **far below** the target line you are not making progress.

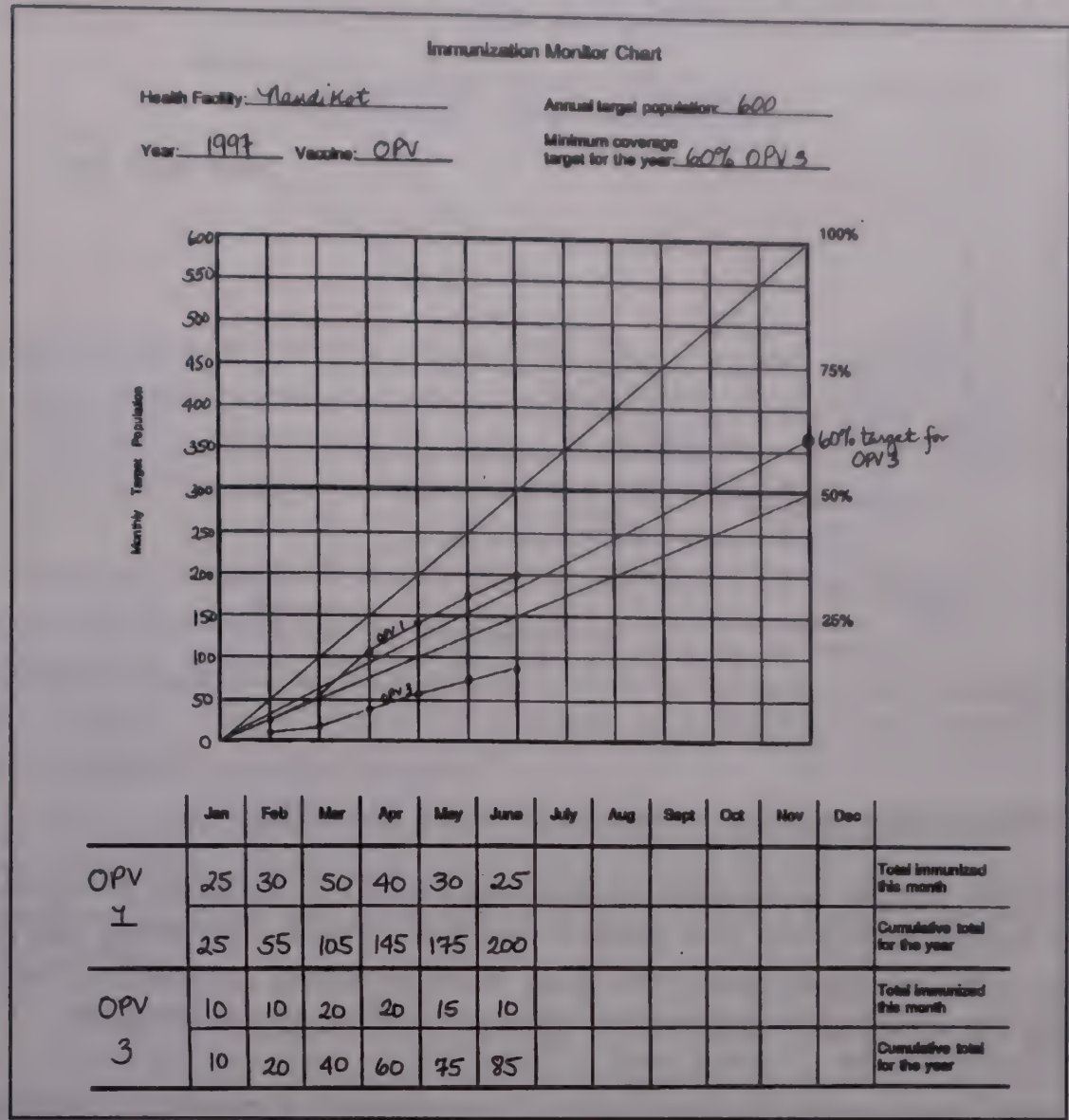
Figure 11-K: Cumulative total line far below target line



- 2) Compare current month's data with those of previous months
 - In the boxes below the graph, look at the number of immunizations given during the current month and compare it to the number given in previous months.
 - Are the numbers increasing or decreasing?

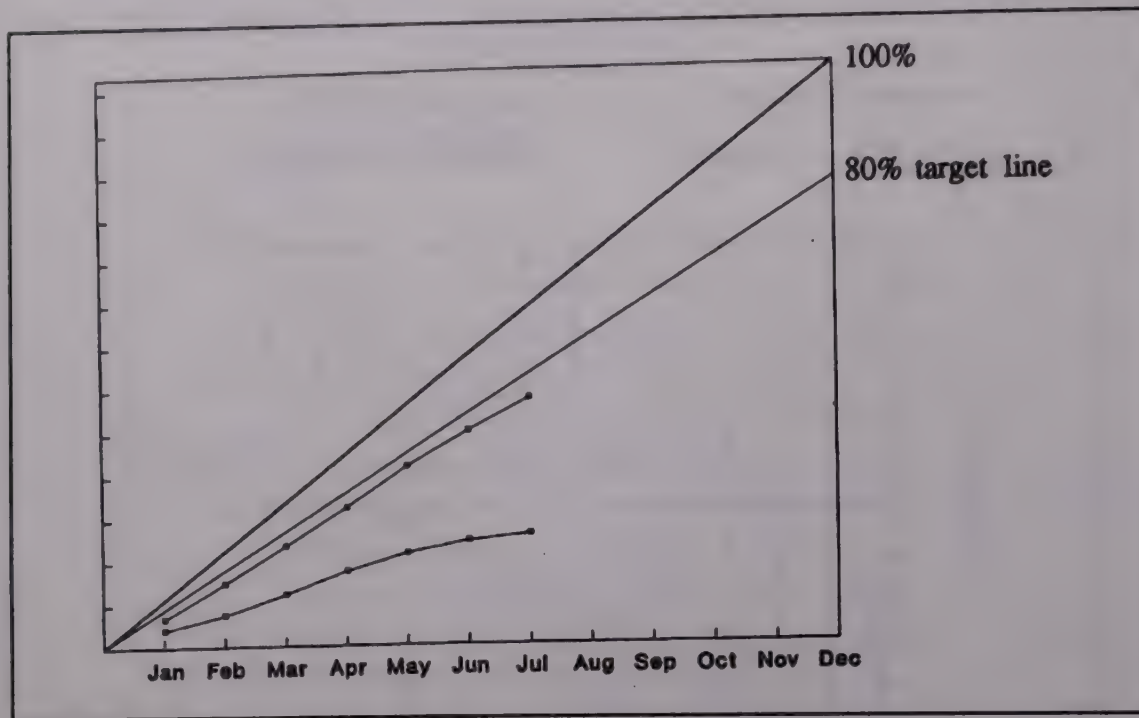
In the figure below, 40, 30 and 25 children received OPV1 in April, May and June respectively; 20, 15 and 10 children received OPV3 in April, May and June respectively. The numbers are decreasing.

Figure 11-L: Immunization monitoring chart for OPV1 and OPV3



- 3) Compare results for two vaccines or two doses of the same vaccine
- Compare the two cumulative total lines for OPV1 and OPV3, DPT1 and DPT3, and BCG and measles vaccines. If the distance between the two cumulative total lines on a chart grows wider every month you have a problem.

Figure 11-M: Drop-out problem



4.2 Protection against neonatal tetanus at birth

To interpret the immunization monitoring chart for children protected at birth against neonatal tetanus you need to compare the line showing the number of mothers who are up-to-date with their tetanus toxoid immunizations with that showing the number of children brought by their mothers for DPT1.

If the two lines are in the same place, the number of protected children equals the number who receive DPT1; and your tetanus toxoid immunization programme is going well.

If the lines do not match, find out why.

5. Identifying problems and their causes

If your data show that you are making progress you can plan how to maintain and increase immunization services. If the data show that you are not reaching coverage targets or that the number of immunizations given each month is decreasing, try to find out why by asking the following questions:

- Are there any groups of people who do not have access to the health centre or to outreach services that you provide?
- Are there any groups of people who have access to, but do not **use**, the health centre? Why? Are they migrants or refugees? Are there religious, ethnic, linguistic or other reasons?
- Do people know about immunizations and ask for them for their children? Do women understand how tetanus toxoid can benefit their newborns and themselves? Do people understand that they need more than one dose of some vaccines?
- Are immunizations provided at convenient times and places? Are children and women immunized quickly or do they have to wait a long time for service?
- Are health workers courteous?
- Are abscesses or other health problems occurring which people believe are caused by immunizations?

5.1 Where can you find the information?

You can identify problems by talking with community leaders, parents and other health centre workers. You may also learn something by looking at what you do during immunization sessions.

- **Community leaders**
Political, religious and other leaders can tell you:
 - where underserved groups live;
 - why people do not use services – this is particularly important.
- **Parents and women of childbearing age** can tell you:
 - whether they are aware of the need for immunizations;
 - why they (or their neighbours) are not using available immunization services – this is particularly important.

Other workers in the health centre can tell you **why** they think parents and women of childbearing age are or are not using immunization services.

- **Immunization sessions**

If you check on what you do in immunization sessions you may discover shortcomings:

- do you always use sterile techniques?
- do you always explain:
 - when to return for the next immunization;
 - where to return for the next immunization;
 - the number of visits needed to complete the immunization schedule;
 - what side-effects might occur;
 - what to do about side-effects?
- Do you always show respect for clients' time and listen to their concerns?

When you have identified problems you can plan actions for solving them.

6. Taking action to increase coverage

After analysing your coverage data you know whether you are making progress, what problems you have, and what is causing them. The next step is to solve the problems and prevent similar ones from occurring in the future. Working with your supervisor, try to develop solutions that you can handle yourself. If possible, plan activities that do not need a lot of additional resources from the district or higher levels.

If people do not have access to immunization services you may want to increase outreach activities. This may require additional vaccines, transport or cold-chain equipment, and you may therefore need to undertake planning with your supervisor.

If people have access to immunization services but are not using them, consider one or more of the following strategies:

- increasing people's knowledge about immunization;
- changing the hours of immunization sessions so that they are more convenient for parents;
- involving community members in solving transport problems;
- training health workers in communication skills, immunization safety, organization of fixed and outreach activities, or other skills that may affect clients' decisions to use the services.

Continue monitoring immunization coverage and acting on what you learn. In this way you can increase protection against all the EPI diseases.

6. Taking Action to Increase

COVERAGE

After analyzing your coverage data and identifying areas for improvement, what problems you have and what is causing them. The next step is to solve the problems and prevent similar ones from occurring in the future. Working with your supervisor, try to develop solutions that you can handle yourself. If possible, plan activities that do not need a lot of additional resources from the district or higher levels.

If people do not have access to immunization services you are trying to increase outreach activities. This may require additional resources, training or field staff equipment, and you may need to coordinate planning with your supervisor.

If people have access to immunization services but are not using them, consider one or more of the following strategies:

- increasing people's knowledge about immunization
- changing the hours of immunization services so that they are more convenient for parents
- involving community members in solving immunization problems
- training health workers in communication skills, immunization safety
- organization of fixed and outreach activities so that they are more effective
- ensuring decisions to use the services

Continue monitoring immunization coverage and acting on what you learn. In this way you can increase protection against all the HIV diseases.

The Global Programme for Vaccines and Immunization, established by the World Health Organization in 1994, defines its goal as "a world in which all people at risk are protected against vaccine-preventable diseases". The Programme comprises three units:

Expanded Programme on Immunization
Vaccine Research and Development
Vaccine Supply and Quality

The Expanded Programme on Immunization focuses on the prevention of selected childhood diseases and, through support to national immunization programmes, aims to achieve 90% immunization coverage of children born each year. Its goals are to eradicate poliomyelitis from the world by the year 2000, reduce measles deaths and incidence, eliminate neonatal tetanus as a public health problem and introduce hepatitis B vaccine in all countries.

Vaccine Research and Development supports and promotes research and development associated with the introduction of new vaccines into the Expanded Programme on Immunization. This includes research and development of new vaccines, improvement of immunization procedures and support to epidemiological studies.

Vaccine Supply and Quality ensures adequate quantities of high quality, affordable vaccines for all the world's children, supports the efforts of governments to become self-reliant as regards their vaccine needs, and assists in the rapid introduction of new vaccines.

The Global Programme for Vaccines and Immunization produces a range of documents, audiovisual materials and software packages to disseminate information on its activities, programme policies, guidelines and recommendations. It also provides materials for group and/or individual training on topics ranging from repair of health centre equipment to curricula guidelines for medical schools, nursing colleges and training of vaccine quality control personnel.

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